



NASA Contractor Report 4747

# Database of Mechanical Properties of Textile Composites

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## **ABSTRACT**

This report describes the approach followed to develop a database for mechanical properties of textile composites. The data in this database is assembled from NASA Advanced Composite Technology (ACT) programs and from data in the public domain. This database meets the data documentation requirements of MIL-HDBK-17, Section 8.1.2, which describes in detail the type and amount of information needed to completely document composite material properties.

The database focuses on mechanical properties of textile composite. Properties are available for a range of parameters such as direction, fiber architecture, material, environmental condition, and failure mode. The composite materials in the database contain innovative textile architectures such as the braided, woven, and knitted materials evaluated under the NASA ACT programs. In summary, the database contains results for approximately 3500 coupon level tests, for ten different fiber/resin combinations, and seven different textile architectures. It also includes a limited amount of prepreg tape composites data from ACT programs where side-by-side comparisons were made.



## Table of Contents

ABSTRACT.....	1
INTRODUCTION.....	4
MATERIALS IN THE DATABASE.....	5
DISCUSSION.....	6
Database Schema.....	6
Collection of Data.....	7
Keypunched Data.....	7
Electronic Data.....	8
Data Quality Assurance.....	8
Data Loading into MVISION.....	9
Working with the Database.....	10
CONCLUSIONS.....	11
ACKNOWLEDGMENT.....	12
REFERENCES.....	12

## INTRODUCTION

This report describes the approach Lockheed Martin Aeronautical Systems (LMAS), Marietta, GA., followed to develop a database for mechanical properties of textile composites and is available on-line from the Langley Technical Report Server (LTRS) via the World Wide Web (WWW). The URL for LTRS is <http://techreports.larc.nasa.gov/ltrs/ltrs.html>. The data in this database is assembled from NASA ACT contractors data and from data in the public domain. This database meets the data documentation requirements of MIL-HDBK-17, Section 8.1.2, which describes in detail the type and amount of information needed to completely document composite material properties. The database was delivered to NASA Langley in electronic format, using the MSC/MVISION™ database manager software, Version 1.2a. All data in the database is stored as individual coupon test results. This database, which is too lengthy to include in this report, is also available on LTRS. The URL for the database is <http://techreports.larc.nasa.gov/ltrs/96/NASA-96-cr4747.refer.html>. A separate executive summary with data group averages, which was developed using Microsoft Excel™, is also available at the same address.

This effort focused on preparation of a database that included textile composite strengths and elastic constants as a function of direction, fiber architecture, material, environmental condition, and failure mode. Mechanical property data includes elastic and strength properties in both in-plane and out-of-plane directions. Elastic properties include

Tension Moduli	Compression Moduli
Shear Moduli	Poisson Terms

and strength properties include

Tensile Strength <sup>1</sup>	Compressive Strength <sup>1</sup>
Unnotched Tension	Unnotched Compression
Open Hole Tension	Open Hole Compression
Filled Hole Tension	Filled Hole Compression
Bearing	Through-the-Thickness Tension
Out-of-Plane Loads	Tension and Compression After Impact
Inplane Shear	Fatigue Damage Resistance
Interlaminar Loads	Biaxial Tension and Compression

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<sup>1</sup> Lamina level tests.



## MATERIALS IN THE DATABASE

This database was developed as a central repository for mechanical properties of textile composite materials. The following types of textile architectures can be found on the database:

2-D triaxial braids	3-D interlock weaves
3-D multiaxial braids	stitched multiaxial warp knits
stitched uniweave fabrics	uniweave fabrics
8 harness fabrics	

In addition, a small amount of unidirectional prepreg tape data is included in the database, as some ACT programs included tape testing as a means of comparison (tape is not considered an architecture within the database, it is stored under Matl\_Form=Tape).

All of the data collected under this effort falls under the graphite/epoxy class. The database includes one type of hybrid material, AS4/IM7/3501-6 in stitched knitted preform. A list of material types and product forms follows.

<u>Material Subclass</u>	<u>Available Product Forms</u>
AS4/3501-6	Uniweaves, Knits, Fabric and Tape
AS4/8551-7	Tape Only
AS4/CET-3	8H Satin Fabric Only
AS4/E905-L	3-D Braid and 8H Satin Fabric
AS4/IM7/3501-6	Stitched Knit Only
AS4/PR-500	Braids, Weaves and Fabrics
AS4/PT-500	3-D Weaves Only
AS4/RSL-1895	Braids, Weaves, Uniweaves and Fabrics
AS4/RSS-1952	8H Satin Fabric Only
IM7/8551-7	Tape Only

Each one of the material types listed above is characterized by a different set of textile parameters, i.e., braids are identified by axial and braid tow sizes, weaves are identified by warp/weft/weaver percentages, etc.

## **DISCUSSION**

### **Database Schema**

Since MSC/MVISION was the chosen database manager software for this task, a database schema was necessary. A schema defines the architecture for storing the data attributes and relations in a hierarchical structure. The textile composite database is meant to comply with MIL-HDBK-17 data and documentation requirements, therefore a standardized composite schema developed by a volunteer committee of MIL-HDBK-17 coordination group members was adopted. Because of the unique characteristics of textiles, this schema was further modified to include a "Preform" level that characterizes the special materials to be handled by this database like braids, 3-D woven and knitted materials. It was also necessary to add more attributes to the schema to handle scalar and text descriptors not anticipated by the standardized composite schema. The final schema for the database is shown in Table 1.

The schema hierarchy structure is as follows:

- Class (material class, schema level...)
  - Material (material name, material form...)
    - Constituent (fiber/matrix class, fiber size...)
      - Preform (textiles preform architecture, preform descriptions...)
        - Process (process method, tackifier information...)
          - Molding (panel layup, NDE method...)
            - Test (test type, test facility, test fixture...)
              - Coupon (nominal coupon geometry)
                - Conditioning (test environment, coupon conditioning...)
                  - Actuals (failure loads/stresses, measured values...)

Class through Conditioning levels are meant to describe in every possible detail the characteristics of a particular coupon so that traceability to its original source is maintained.

All the measured mechanical, hygrothermal and graphical information collected for a particular test is stored under the Actuals level.

### Collection of Data

The names and associated reports/technical memorandums listed in the references section were identified by NASA Langley as the sources for textile composites data. Many of those listed were participants in the NASA ACT programs, and included individuals in the aerospace industry, educational facilities and government branches. All sources listed were contacted and asked to provide data in electronic format if possible. Otherwise they were asked to provide the reports/TMs containing the data which would be entered by keypunching at a later time. Even in cases where electronic data was available, written reports were also provided to ensure that data quality was maintained.

Collection of written reports/TMs was accomplished through regular mail directly from the identified source or from NASA Langley. In some cases the reports were obtained from the local LMAS technical library. Collection of electronic data was accomplished via two ways; 1) the data was mailed to the author on 3.5" floppy disk for loading into the LAN, or 2) e-mailed directly to the author. While both of these methods proved to be efficient ways to transfer data, direct e-mail obviously is faster. Since MVISION is a UNIX based software package, it was necessary to use an Apple Macintosh with a data translator program like Stuffit Expander™ or the like, in order to receive data originated on personal computers that were transmitted as encoded files. Once decoded, the data could be manipulated on a PC and transferred to the UNIX workstation as a text file for subsequent loading into MVISION.

The largest collection of data was obtained from Ref. [1], testing performed by the Boeing Defense & Space Group in Philadelphia, PA. Reference [12], testing performed by Lockheed Martin Aeronautical Systems, also proved to be a sizable amount of data. It was this data source that served as the foundation for the textiles composites database since it was already stored in MVISION.

### Keypunched Data

Data that was not available in electronic format was typed into electronic spreadsheets from tables provided in the written reports. The data was typed in with one row of attribute identifiers, and the attribute values entered in columnar fashion. An example of keypunched data is shown in Figure 1. A separate spreadsheet was created for each individual test type in order to minimize mistakes and to simplify the loading process into MVISION. Due to the time and expense associated with keypunching data, only tabular data was loaded into the database, i.e., no load-stroke or stress-strain data was loaded into the database for data not provided in electronic format.

### Electronic Data

Data in electronic format was usually provided to the author in the form of one or more spreadsheets. In some cases, electronic text files were provided that were easily imported into a spreadsheet for data manipulation. In most cases, the data consisted of measured values of specimen geometry and failure loads/stresses. This data would then be augmented with material characterization and material processing information from the accompanying written report, put into a format similar to that shown in Figure 1, and loaded into MVISION.

### Data Quality Assurance

Although mistakes are inevitable as data is loaded into the database, one goal under this task was to end up with a zero defect database. A quality assurance procedure was established that included the following steps to be performed by LMAS:

- (1) Conduct initial sanity checks on all incoming data by reviewing the data visually.
- (2) Periodically review all new data on the database, in conjunction with periodic releases of database updates.
- (3) Maintain copies of old databases, and archive all incoming data. This includes files with the reduced data for loading into MVISION.

Inconsistencies found in step (1) were cleared with the data sender prior to loading into the database. In addition to the QA steps already mentioned, standard input forms (in both paper and electronic format) were developed to maintain consistency and minimize typing in the case of keypunched data. Table 2 shows a sample input form for electronic data. For future NASA programs that have mechanical testing, it is recommended that a similar form be provided to the test laboratory as the preferred method of file storage/transfer. Once the relevant data is stored into such a form, inclusion of the data into a database is greatly simplified.

Quality assurance was further emphasized on the keypunched data by the creation of an automated procedure which searched the data file for a particular parameter and then assigned the common attributes for that specimen. This UNIX script called *ren*, searched the file for the preform ID (e.g., SLL), then assigned values associated with that ID to known attributes like “preform\_arch, %\_axial\_yarn, %\_braid\_yarn, braid\_angle, unit\_cell\_width and unit\_cell\_length”. This procedure substantially reduced the amount of keypunch, which consequently minimizes mistakes. It also provides for common and consistent attribute values for like specimens, a very important detail for this type of database. The *ren* script also performs a number of other formatting checks like deleting any whitespace at the beginning and end of all entries, it deletes any extra tabs, it makes sure the data file is properly delimited, converts all entries to upper case, etc. All these checks lead to a ‘cleaner’ data file prior to loading and a database that is easier to use.

One final quality check was performed in conjunction with the preparation of data executive summaries. Since this task consisted of downloading the data from the database, sorting and grouping it, cases where material constituents and/or measured values seemed inconsistent were reviewed against the original data source and corrected if necessary.

### Data Loading into MVISION

Three different approaches were used for data loading into MVISION depending on the data origin:

- (1) data that was already in MVISION format,
- (2) data that was keypunched, and
- (3) data received electronically.

For traceability purposes, all information that could possibly be gathered was loaded into the database. In several instances the schema was modified/expanded to accommodate the available information. The data was loaded using customary English units.

Step (1) involved taking data from an existing database and reformatting it. At the time this task started, data from Ref. [12] already had been loaded into MVISION but with a different schema. This data acted as the foundation for the textiles database first version. An MVISION spreadsheet that performed a one-to-one translation from its original schema to the MIL-17 schema was created and the data reloaded in one step. This portion of the data contained load-stroke and stress-strain curves.

Data that was keypunched (step (2)), was reviewed and manipulated using common spreadsheet programs and reformatted into individual files (one data file per specimen). The individual files were then submitted to the QA checks discussed previously, and read individually into an MVISION spreadsheet as shown in Figure 2. The files were categorized by test type in order to simplify the loading process. Since the number of files varied from a few dozen to hundreds depending on test type, MVISION session files were created to automate the loading process. The session file essentially read a data file into an MVISION spreadsheet, loaded the data using the MVISION *put* function, and then moved on to the next file until all specified files were loaded. New versions of the database were created prior to loading of new data to maintain traceability.

Data from step (3) was treated differently since most of the necessary information had already been provided in spreadsheet type format. Any missing information was added directly into the spreadsheet, then the entire block of data was exported as a text file and read into a new MVISION spreadsheet as shown in Figure 3. Then a single *put* statement covering the range of data loaded the information into the database.

### Working with the Database

This section is designed to provide some tips on working with the database and using MVISION. Some knowledge about the material constituents is necessary to work with and query the database. Since not all users of the database will be familiar with MVISION

terminology and/or textile composite materials, a copy of the schema is provided in Table 1 to help the user navigate the database.

One of the most useful tools within MVISION is the Query panel. This tool helps the user to limit the information displayed to specific materials or materials with particular properties. Since this database is of moderate size (~17 megabytes) and contains a variety of materials, using the Query panel is the most efficient way to view the data. Figure 4 shows an example of a query specific to this textile database. After the query is executed, the database only displays the AS4/RSL-1895 material for product forms that are stitched. Note that the word *stitched* was enclosed with asterisks on the query command. This tells MVISION to display AS4/RSL-1895 materials for any kind of stitched preform architecture, since the asterisk is used as a wildcard character. The user needs to recognize that MVISION is trying to match the word *stitched* as it searches the database. Any spelling mistakes will return a message saying that no data was found.

At this point the data displayed by MVISION should be of much smaller scale and the user can concentrate on a particular product. He can go back to the Query panel and expand the query to limit the displayed information even more. The Query panel can also be used to display data for two different materials by using operators like *and* or *or*, or by using numerical operators. This is especially useful for side-by-side comparisons of two or more materials.

Another useful database tool is the select command within the MVISION spreadsheet. The select command performs a specified query on the database, and it returns the values of selected attributes. Figure 5 shows an example of the select panel. It is very similar to the Query panel except it contains an 'Attribute to Select' box at the top of the panel where the user specifies the attributes of interest. Once the user fills the select and query boxes and hits the Apply button, MVISION returns the values to the spreadsheet as shown in Figure 6. At this point the data can be sorted or manipulated in any way the user deems necessary. The data can also be written electronically to a file for use in a report, imported to another spreadsheet, plotted with a plotting software package, etc.

## CONCLUSIONS

In summary, the effort under this task accomplished the following:

- A mechanical properties database has been created for textile composite materials. It provides a single source where all the data can be found in one place, and facilitates extraction and/or sharing of data within NASA customers.
- The database utilizes a modified standardized composites schema which meets MIL-HDBK-17 data documentation requirements. Use of this schema will help standardize naming scheme conventions throughout the industry.
- The database contains results for approximately 3500 coupon level tests, for ten different fiber/resin combinations, and seven different textile architectures.

## **ACKNOWLEDGMENT**

The author would like to thank Mr. C.C. (Buddy) Poe of the NASA Langley Research Center for his help in gathering some of the necessary data for this task. The author would also like to thank Mr. C.D. Boshers of Lockheed Martin Tactical Aircraft Systems for his work in developing the implementation plan and for his invaluable support during the data loading stages of the database.

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**TABLE 1. TEXTILES COMPOSITES DATABASE MVISION SCHEMA**

```

$ Textile Composite Data Schema Version 4 Version date 3-22-95 agd
$
$ {Revised several descriptions 4-28-95 agd}
$ {Added Gage1 and Gage2 to attribute list 5-09-95 agd}
$ {Changed Gage1 and Gage2 to Gage_Strain1 and
$ Gage_Strain2, added Gage_Mod1 and Gage_Mod 25-11-95 agd}
$ {Added Notch_Depth1, Notch_Depth2, Overlap 6-12-95 agd}
$ {Added Axial_Stress, Hoop_Stress, Axial_Strain,
$ Hoop_Strain, Braid_Strain 7-10-95 agd}
$ {Added Edge_Distance, GIC_Area_Method,
$ GIC_Init_Method, GIC 7-12-95 agd}
$ {Added Strain_Mean 7-27-95 agd}
$ {Changed Temperature_Lab, RH_Lab, Temperature_Test and
$ RH_Test from 'Actuals' level to 'Mechanical' level
$ to ensure all coupons have at least
$ one unique common attribute in table data level. 7-31-95 agd}
$ {Added Ftai and ecai. 8-24-95 agd}
$ {Added etai. 9-05-95 agd}
$
$ The following schema is a draft version of a MIL-17 compliant schema
$ to be used to for the Textile Composite Database prepared for NASA.
$ This schema is based on the draft MIL-17 schema prepared by the M/VISION
$ interest group.
$
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$ 34736.00
$ Schema Relations:
$ Class
$ Material
$ Constituent
$ Preform
$ Process
$ Molding
$ Test
$ Coupon
$ Conditioning
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TABLE 1. CONTINUED

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|-----------------|------------------------------|------|-------|------|------------|---------------------------------|
| ATTRIBUTE ADD   | Matl_Tg_Dry                  | real | 1.00  | 1.00 | deg F      | Material nominal dry Tg         |
| ATTRIBUTE ADD   | Matl_Tg_Wet                  | real | 1.00  | 1.00 | deg F      | Material nominal wet Tg         |
| ATTRIBUTE ADD   | CNAME                        | char | 80.00 | 1.00 | -0-        | Synonym for Material_Name       |
| \$              |                              |      |       |      |            |                                 |
| \$              | Constituent                  |      |       |      |            |                                 |
| \$              | Reinforcement (an exception) |      |       |      |            |                                 |
| \$              | Fiber                        |      |       |      |            |                                 |
| \$              | Tow                          |      |       |      |            |                                 |
| \$              | Matrix                       |      |       |      |            |                                 |
| \$              | Filler                       |      |       |      |            |                                 |
| \$              | Fabric                       |      |       |      |            |                                 |
| \$              | Tracer                       |      |       |      |            |                                 |
| \$              |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fiber_Name                   | char | 80.00 | 1.00 | -0-        | Fiber common name               |
| ATTRIBUTE ADD   | Matrix_Name                  | char | 80.00 | 1.00 | -0-        | Matrix common name              |
| ATTRIBUTE ADD   | Matrix_Subclass              | char | 80.00 | 1.00 | -0-        | Matrix polymer class            |
| ATTRIBUTE ADD   | Matrix_Sub_Fam               | char | 80.00 | 1.00 | -0-        | Matrix subfamily                |
| \$              |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Reinf_Class                  | char | 80.00 | 1.00 | -0-        | Reinforcement Class             |
| ATTRIBUTE ADD   | Fiber_Desig                  | char | 80.00 | 1.00 | -0-        | Fiber mfr internal designation  |
| ATTRIBUTE ADD   | Fiber_Chem_Fam               | char | 80.00 | 1.00 | -0-        | Fiber chemical family           |
| ATTRIBUTE ADD   | Fiber_Sub_Fam                | char | 80.00 | 1.00 | -0-        | Fiber chemical sub-family       |
| ATTRIBUTE ADD   | Fiber_Class                  | char | 80.00 | 1.00 | -0-        | Fiber classification            |
| ATTRIBUTE ADD   | Fiber_Subclass               | char | 80.00 | 1.00 | -0-        | Fiber subclassification         |
| ATTRIBUTE ADD   | Fiber_Mfr                    | char | 80.00 | 1.00 | -0-        | Fiber manufacturer              |
| ATTRIBUTE ADD   | Fiber_Spec_Mfr               | char | 80.00 | 1.00 | -0-        | Fiber mfr specification         |
| number          |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fiber_Spec_User              | char | 80.00 | 1.00 | -0-        | Fiber user specification        |
| number          |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fiber_Lot                    | char | 80.00 | 1.00 | -0-        | Fiber manufacturer lot number   |
| ATTRIBUTE ADD   | Fiber_Density                | real | 1.00  | 1.00 | Mg/m^3     | Average fiber density           |
| ATTRIBUTE ADD   | Fiber_Fil_Dia                | real | 1.00  | 1.00 | micrometre | Fiber filament diameter         |
| ATTRIBUTE ADD   | Tow_Count                    | int  | 1.00  | 1.00 | count      | Fiber tow count per strand/tow  |
| ATTRIBUTE ADD   | Tow_Lin_Density              | real | 1.00  | 1.00 | tex        | Fiber tow/strand linear         |
| density         |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Tow_Yield                    | real | 1.00  | 1.00 | m/g        | Fiber tow/strand yield          |
| ATTRIBUTE ADD   | Tow_Twist                    | real | 1.00  | 1.00 | t/m        | Fiber tow/strand twist amount   |
| ATTRIBUTE ADD   | Tow_Twist_Type               | char | 1.00  | 1.00 | -0-        | Fiber tow twist, Z or S or N    |
| ATTRIBUTE ADD   | Fiber_Treat_Name             | char | 80.00 | 1.00 | -0-        | Fiber surface treatment         |
| name            |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fiber_Treat_Dtls             | char | 80.00 | 1.00 | -0-        | Fiber surface treatment         |
| details         |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fiber_Szng_Name              | char | 80.00 | 1.00 | -0-        | Fiber sizing name               |
| ATTRIBUTE ADD   | Fiber_Szng_Wt%               | real | 1.00  | 1.00 | Wt %       | Fiber sizing content by         |
| weight %        |                              |      |       |      |            |                                 |
| \$              |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Matrix_Desig                 | char | 80.00 | 1.00 | -0-        | Matrix mfr internal designation |
| ATTRIBUTE ADD   | Matrix_Class                 | char | 80.00 | 1.00 | -0-        | Matrix Class                    |
| ATTRIBUTE ADD   | Matrix_Chem_Fam              | char | 80.00 | 1.00 | -0-        | Matrix chemical family          |
| ATTRIBUTE ADD   | Matrix_Mfr                   | char | 80.00 | 1.00 | -0-        | Matrix manufacturer name        |
| ATTRIBUTE ADD   | Matrix_Spec_Mfr              | char | 80.00 | 1.00 | -0-        | Matrix mfr specification        |
| number          |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Matrix_Lot                   | char | 80.00 | 1.00 | -0-        | Matrix mfr lot number           |
| ATTRIBUTE ADD   | Matrix_Density               | real | 1.00  | 1.00 | Mg/m^3     | Matrix average density          |
| \$              |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Filler_Name                  | char | 80.00 | 1.00 | -0-        | Filler common name              |
| ATTRIBUTE ADD   | Filler_Amount                | real | 1.00  | 1.00 | Wt %       | Filler content by weight %      |
| \$              |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fabric_Mfr                   | char | 80.00 | 1.00 | -0-        | Fabric weaver name              |
| ATTRIBUTE ADD   | Fabric_Style                 | char | 80.00 | 1.00 | -0-        | Fabric weave style              |
| ATTRIBUTE ADD   | Fabric_Spec_Mfr              | char | 80.00 | 1.00 | -0-        | Fabric mfr specification        |
| number          |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fabric_Spec_User             | char | 80.00 | 1.00 | -0-        | Fabric user specification       |
| number          |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fabric_Lot                   | char | 80.00 | 1.00 | -0-        | Fabric mfr weave lot            |
| ATTRIBUTE ADD   | Fabric_Szng_Name             | char | 80.00 | 1.00 | -0-        | Fabric sizing common name       |
| ATTRIBUTE ADD   | Fabric_Szng_Wt%              | real | 1.00  | 1.00 | Wt %       | Fabric sizing content by        |
| weight %        |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fabric_End_Cnt               | real | 1.00  | 1.00 | count/in   | Fabric warp end count per       |
| unit length     |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fabric_Fill_Name             | char | 80.00 | 1.00 | -0-        | Uniweave fabric fill fiber      |
| type            |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Fabric_Pick_Cnt              | real | 1.00  | 1.00 | count/in   | Fabric fill pick count          |
| per unit length |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Tracer_Warp_Name             | char | 80.00 | 1.00 | -0-        | Fabric warp tracer common       |
| name            |                              |      |       |      |            |                                 |
| ATTRIBUTE ADD   | Tracer_Warp_LD               | real | 1.00  | 1.00 | tex        | Fabric warp tracer linear       |
| density         |                              |      |       |      |            |                                 |

TABLE 1. CONTINUED

|                       |                              |      |       |      |        |  |
|-----------------------|------------------------------|------|-------|------|--------|--|
| ATTRIBUTE ADD         | Tracer_Warp_Spac             | real | 1.00  | 1.00 | in     | Fabric warp tracer linear spacing              |
| ATTRIBUTE ADD         | Tracer_Warp_Szng             | char | 80.00 | 1.00 | -0-    | Fabric warp tracer sizing name                 |
| ATTRIBUTE ADD         | Tracer_Fill_Name             | char | 80.00 | 1.00 | -0-    | Fabric fill tracer common name                 |
| ATTRIBUTE ADD         | Tracer_Fill_LD               | real | 1.00  | 1.00 | tex    | Fabric fill tracer linear density              |
| ATTRIBUTE ADD         | Tracer_Fill_Spac             | real | 1.00  | 1.00 | in     | Fabric fill tracer linear spacing              |
| ATTRIBUTE ADD         | Tracer_Fill_Szng             | char | 80.00 | 1.00 | -0-    | Fabric fill tracer sizing name                 |
| \$                    |                              |      |       |      |        |  |
| \$                    | Preform (added for textiles) |      |       |      |        |  |
| \$                    |                              |      |       |      |        |  |
| ATTRIBUTE ADD         | Preform_Arch                 | char | 80.00 | 1.00 | -0-    | Preform Architecture                           |
| ATTRIBUTE ADD         | Preform_ID                   | char | 80.00 | 1.00 | -0-    | Preform Identifier                             |
| ATTRIBUTE ADD         | Preform_Mfr                  | char | 80.00 | 1.00 | -0-    | Preform Manufacturer                           |
| ATTRIBUTE ADD         | Fiber_Axial                  | char | 80.00 | 1.00 | -0-    | Axial Fiber Type                               |
| ATTRIBUTE ADD         | Fiber_Braid                  | char | 80.00 | 1.00 | -0-    | Braid Fiber Type                               |
| ATTRIBUTE ADD         | Stitch_Type                  | char | 80.00 | 1.00 | -0-    | Stitch Classification                          |
| ATTRIBUTE ADD         | Stitch_Thread                | char | 80.00 | 1.00 | -0-    | Stitching Thread Material                      |
| ATTRIBUTE ADD         | Stitch_Pitch                 | real | 1.00  | 1.00 | deg    | Stitch Axial Pitch                             |
| ATTRIBUTE ADD         | Stitch_Spacing               | real | 1.00  | 1.00 | in     | Stitch Row Spacing                             |
| ATTRIBUTE ADD         | Size_Axial                   | real | 1.00  | 1.00 | K      | Number of Fiber Filaments in Axial Yarn        |
| ATTRIBUTE ADD         | Size_Braid                   | real | 1.00  | 1.00 | K      | Number of Fiber Filaments in Braider Yarn      |
| ATTRIBUTE ADD         | Size_Stitch                  | real | 1.00  | 1.00 | denier | Weight in Grams per 9000 meters                |
| ATTRIBUTE ADD         | Size_Stitch_Tow              | real | 1.00  | 1.00 | K      | Number of Fiber Filaments in Stitch            |
| ATTRIBUTE ADD         | Braid_Angle                  | real | 1.00  | 1.00 | deg    | Positive Braid Angle w.r.t. Axial Yarn         |
| ATTRIBUTE ADD         | Braid_End_Count              | int  | 1.00  | 1.00 | tow/in | Bias Yarn End Count                            |
| ATTRIBUTE ADD         | Braid_TTT_Angle              | real | 1.00  | 1.00 | deg    | Bias Yarn Angle                                |
| Through-the-Thickness |                              |      |       |      |        |  |
| ATTRIBUTE ADD         | %_Axial_Yarn                 | real | 1.00  | 1.00 | %      | Percentage of Axial Yarn                       |
| ATTRIBUTE ADD         | %_Braid_Yarn                 | real | 1.00  | 1.00 | %      | Percentage of Braider Yarn                     |
| ATTRIBUTE ADD         | Axial_Spacing                | real | 1.00  | 1.00 | in     | Axial Yarn Spacing in Braids                   |
| ATTRIBUTE ADD         | Unit_Cell_Width              | real | 1.00  | 1.00 | in     | Unit Cell Width in Braids                      |
| ATTRIBUTE ADD         | Unit_Cell_Length             | real | 1.00  | 1.00 | in     | Unit Cell Length in Braids                     |
| ATTRIBUTE ADD         | Interlock_Class              | char | 80.00 | 1.00 | -0-    | Interlock Description for 3-D Woven Mats       |
| ATTRIBUTE ADD         | Size_Warp                    | real | 1.00  | 1.00 | K      | Number of Fiber Filament in Warp Yarn          |
| ATTRIBUTE ADD         | Size_Weft                    | real | 1.00  | 1.00 | K      | Number of Fiber Filament in Weft Yarn          |
| ATTRIBUTE ADD         | Size_Angle_Yarn              | real | 1.00  | 1.00 | K      | Number of Fiber Filament in Angle Yarn         |
| ATTRIBUTE ADD         | Size_Weaver                  | real | 1.00  | 1.00 | K      | Number of Fiber Filament in Weaver Yarn        |
| ATTRIBUTE ADD         | %_Warp                       | real | 1.00  | 1.00 | %      | Percentage of Warp Yarn                        |
| ATTRIBUTE ADD         | %_Weft                       | real | 1.00  | 1.00 | %      | Percentage of Weft Yarn                        |
| ATTRIBUTE ADD         | Angle_Yarn_Angle             | real | 1.00  | 1.00 | deg    | Positive Angle of Angle Yarn w.r.t. Axial Yarn |
| ATTRIBUTE ADD         | %_Angle_Yarn                 | real | 1.00  | 1.00 | %      | Percentage of Angle Yarn                       |
| ATTRIBUTE ADD         | %_Weaver                     | real | 1.00  | 1.00 | %      | Percentage of Weaver Yarn                      |
| ATTRIBUTE ADD         | %_TTT                        | real | 1.00  | 1.00 | %      | Percentage of Through-the-Thickness Yarn       |
| ATTRIBUTE ADD         | Woven_Pitch_Len              | real | 1.00  | 1.00 | in     | Pitch Length in Woven                          |
| ATTRIBUTE ADD         | Warp_End_Count               | int  | 1.00  | 1.00 | tow/in | Warp Yarn End Count                            |
| ATTRIBUTE ADD         | Weft_End_Count               | int  | 1.00  | 1.00 | tow/in | Weft Yarn End Count                            |
| ATTRIBUTE ADD         | NLayer                       | int  | 1.00  | 1.00 | -0-    | Number of preform layers                       |
| \$                    |                              |      |       |      |        |  |
| \$                    | Prepreg                      |      |       |      |        |  |
| \$                    | Batch                        |      |       |      |        |  |
| \$                    |                              |      |       |      |        |  |
| ATTRIBUTE ADD         | Prepreg_Source               | char | 80.00 | 1.00 | -0-    | Prepreg supplier                               |
| ATTRIBUTE ADD         | Prepreg_RC                   | real | 1.00  | 1.00 | Wt %   | Prepreg nominal matrix weight %                |
| ATTRIBUTE ADD         | Prepreg_FAW                  | real | 1.00  | 1.00 | g/m^2  | Prepreg nominal FAW                            |
| \$                    |                              |      |       |      |        |  |
| ATTRIBUTE ADD         | Prepreg_Mfr                  | char | 80.00 | 1.00 | -0-    | Prepreg manufacturer name                      |
| ATTRIBUTE ADD         | Prepreg_Spec                 | char | 80.00 | 1.00 | -0-    | Prepreg mfr internal specification             |
| ATTRIBUTE ADD         | Prepreg_VC                   | real | 1.00  | 1.00 | Wt %   | Prepreg nominal volatiles weight %             |
| ATTRIBUTE ADD         | Prepreg_Width                | real | 1.00  | 1.00 | in     | Prepreg nominal width                          |
| ATTRIBUTE ADD         | Prepreg_Orient               | real | 1.00  | 1.00 | deg    | Prepreg nominal orientation                    |

TABLE 1. CONTINUED

|                         |                  |      |        |      |       |                                    |
|-------------------------|------------------|------|--------|------|-------|------------------------------------|
| ATTRIBUTE ADD \$        | Prepreg_Notes    | char | 700.00 | 1.00 | -0-   | Notes about prepreg                |
| ATTRIBUTE ADD           | Batch_Number     | char | 80.00  | 1.00 | -0-   | Prepreg mfr batch number           |
| ATTRIBUTE ADD           | Batch_Cert       | char | 80.00  | 1.00 | -0-   | Prepreg batch certification        |
| ATTRIBUTE ADD           | Batch_Exp_Date   | char | 10.00  | 1.00 | -0-   | Prepreg batch expiration date      |
| ATTRIBUTE ADD           | Batch_Roll_Num   | char | 80.00  | 1.00 | -0-   | Prepreg batch mfr                  |
| roll/sub-roll number \$ |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Resin_Lot  | char | 80.00  | 1.00 | -0-   | Prepreg batch matrix lot           |
| number(s)               |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Resin_DOM  | char | 80.00  | 1.00 | -0-   | Prepreg batch resin lot date       |
| of mfr                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Fiber_Lot  | char | 80.00  | 1.00 | -0-   | Prepreg batch fiber lot            |
| number(s)               |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Fiber_DOM  | char | 80.00  | 1.00 | -0-   | Prepreg batch fiber lot date       |
| of mfr                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Fiber_Cert | char | 80.00  | 1.00 | -0-   | Prepreg batch fiber cert           |
| number(s)               |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Fabric_Lot | char | 80.00  | 1.00 | -0-   | Prepreg batch fabric lot           |
| number(s)               |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Fabric_DOM | char | 80.00  | 1.00 | -0-   | Prepreg batch fabric lot           |
| date of mfr             |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Fab_Cert   | char | 80.00  | 1.00 | -0-   | Prepreg batch fabric cert          |
| number(s)               |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_RC         | real | 1.00   | 1.00 | Wt %  | Prepreg batch resin/matrix content |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_RC_TM      | char | 80.00  | 1.00 | -0-   | Prepreg batch resin content test   |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_FAW        | real | 1.00   | 1.00 | g/m^2 | Prepreg batch fiber areal weight   |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_FAW_TM     | char | 80.00  | 1.00 | -0-   | Prepreg batch FAW test method      |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_VC         | real | 1.00   | 1.00 | Wt %  | Prepreg batch volatiles content    |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_VC_TM      | char | 80.00  | 1.00 | -0-   | Prepreg batch VC test method       |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Flow       | real | 1.00   | 1.00 | Wt %  | Prepreg batch resin flow           |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Flow_TM    | char | 80.00  | 1.00 | -0-   | Prepreg batch resin flow test      |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_GelTime    | real | 1.00   | 1.00 | min   | Prepreg batch gel time             |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_GelTime_TM | char | 80.00  | 1.00 | -0-   | Prepreg batch gel time test        |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Tack       | char | 80.00  | 1.00 | -0-   | Prepreg batch tack                 |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Tack_TM    | char | 80.00  | 1.00 | -0-   | Prepreg batch tack test method     |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Tg_Dry     | real | 1.00   | 1.00 | deg F | Prepreg batch glass transition     |
| temp                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Batch_Tg_Dry_TM  | char | 80.00  | 1.00 | -0-   | Prepreg batch glass                |
| transition temp TM      |                  |      |        |      |       |                                    |
| \$                      |                  |      |        |      |       |                                    |
| \$                      | Process          |      |        |      |       |                                    |
| \$                      | Process          |      |        |      |       |                                    |
| \$                      | Tackifier        |      |        |      |       |                                    |
| \$                      | Molded           |      |        |      |       |                                    |
| \$                      |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Method   | char | 80.00  | 1.00 | -0-   | Molding consolidation/cure         |
| method                  |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Temp     | real | 1.00   | 1.00 | deg F | Nominal as-molded                  |
| cure/consolid. temp     |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Molded_CPT       | real | 1.00   | 1.00 | in    | Nominal as-molded cured ply        |
| thickness               |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Molded_Vf        | real | 1.00   | 1.00 | Vol % | Nominal as-molded fiber volume     |
| \$                      |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Tackifier_Name   | char | 80.00  | 1.00 | -0-   | Tackifier common name              |
| ATTRIBUTE ADD           | Tackifier_Type   | char | 80.00  | 1.00 | -0-   | Tackifier type                     |
| ATTRIBUTE ADD           | Tackifier_Mfr    | char | 80.00  | 1.00 | -0-   | Tackifier manufacturer             |
| \$                      |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Step_1   | char | 80.00  | 1.00 | -0-   | Description of 1st process         |
| step                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Temp_1   | real | 1.00   | 1.00 | deg F | Temperature of 1st process         |
| step                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Press_1  | real | 1.00   | 1.00 | psig  | Pressure during 1st process        |
| step                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Vac_1    | real | 1.00   | 1.00 | psig  | Vacuum during 1st process step     |
| step                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Time_1   | real | 1.00   | 1.00 | min   | Elapsed time of 1st process        |
| step                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Notes_1  | char | 700.00 | 1.00 | -0-   | Notes on 1st process step          |
| \$                      |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Step_2   | char | 80.00  | 1.00 | -0-   | Description of 2nd process         |
| step                    |                  |      |        |      |       |                                    |
| ATTRIBUTE ADD           | Process_Temp_2   | real | 1.00   | 1.00 | deg F | Temperature of 2nd process         |
| step                    |                  |      |        |      |       |                                    |

TABLE 1. CONTINUED

|                      |                  |      |        |      |        |                                    |
|----------------------|------------------|------|--------|------|--------|------------------------------------|
| ATTRIBUTE ADD        | Process_Press_2  | real | 1.00   | 1.00 | psig   | Pressure during 2nd process        |
| step                 |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Process_Vac_2    | real | 1.00   | 1.00 | psig   | Vacuum during 2nd process step     |
| ATTRIBUTE ADD        | Process_Time_2   | real | 1.00   | 1.00 | min    | Elapsed time of 2nd process        |
| step                 |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Process_Notes_2  | char | 700.00 | 1.00 | -0-    | Notes on 2nd process step          |
| \$                   |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Molded_Density   | real | 1.00   | 1.00 | Mg/m^3 | Nominal as-molded density          |
| ATTRIBUTE ADD        | Molded_VC        | real | 1.00   | 1.00 | Vol %  | Nominal as-molded void content     |
| ATTRIBUTE ADD        | Molded_RC        | real | 1.00   | 1.00 | Wt %   | Nominal as-molded resin content    |
| ATTRIBUTE ADD        | Molded_Thickness | real | 1.00   | 1.00 | in     | Nominal as-molded total            |
| thickness            |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Molded_Tg_Dry    | real | 1.00   | 1.00 | deg F  | Nominal as-molded dry Tg           |
| ATTRIBUTE ADD        | Molded_Tg_Dry_TM | char | 80.00  | 1.00 | -0-    | Dry Tg test method                 |
| ATTRIBUTE ADD        | Molded_Tg_Wet    | real | 1.00   | 1.00 | deg F  | Nominal as-molded wet Tg           |
| ATTRIBUTE ADD        | Molded_Tg_Wet_TM | char | 80.00  | 1.00 | -0-    | Wet Tg test method                 |
| ATTRIBUTE ADD        | Molded_Xt_Temp   | real | 1.00   | 1.00 | deg F  | Nominal as-molded                  |
| crystallization temp |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Molded_Melt_Temp | real | 1.00   | 1.00 | deg F  | Nominal as-molded melt             |
| temp                 |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Molded_Form      | char | 80.00  | 1.00 | -0-    | Form of molding: panel, tube,      |
| part, etc            |                  |      |        |      |        |                                    |
| \$                   |                  |      |        |      |        |                                    |
| \$                   | Molding          |      |        |      |        |                                    |
| \$                   | Panel            |      |        |      |        |                                    |
| \$                   | Process          |      |        |      |        |                                    |
| \$                   | Tackifier        |      |        |      |        |                                    |
| \$                   | NDE              |      |        |      |        |                                    |
| \$                   | Core             |      |        |      |        |                                    |
| \$                   | Adhesive         |      |        |      |        |                                    |
| \$                   |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Panel_Layup_Code | char | 80.00  | 1.00 | -0-    | Panel layup code                   |
| ATTRIBUTE ADD        | Panel_ID         | char | 80.00  | -0-  |        | Panel Identification               |
| ATTRIBUTE ADD        | Panel_CPT        | real | 1.00   | 1.00 | in     | Panel average cured ply thickness  |
| ATTRIBUTE ADD        | Panel_Vf         | real | 1.00   | 1.00 | Vol %  | Panel average fiber volume         |
| \$                   |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Panel_Drawing    | char | 80.00  | 1.00 | -0-    | Panel Drawing Number               |
| ATTRIBUTE ADD        | Panel_Ply_Count  | int  | 1.00   | 1.00 | -0-    | Panel ply count                    |
| ATTRIBUTE ADD        | Panel_Stack_Sym  | char | 80.00  | 1.00 | -0-    | Panel midplane harness-weave       |
| symmetry             |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Panel_%0         | real | 1.00   | 1.00 | %      | Panel percent 0 deg plies          |
| ATTRIBUTE ADD        | Panel_%45        | real | 1.00   | 1.00 | %      | Panel percent 45 deg plies         |
| ATTRIBUTE ADD        | Panel_%90        | real | 1.00   | 1.00 | %      | Panel percent 90 deg plies         |
| ATTRIBUTE ADD        | Panel_Cut_Plan   | char | 80.00  | 1.00 | -0-    | Panel cutting plan                 |
| ATTRIBUTE ADD        | Panel_Labeling   | char | 80.00  | 1.00 | -0-    | Panel labeling scheme              |
| ATTRIBUTE ADD        | Panel_Sampling   | char | 80.00  | 1.00 | -0-    | Panel sampling method              |
| ATTRIBUTE ADD        | Panel_Label_Mthd | char | 80.00  | 1.00 | -0-    | Panel labeling method(s)           |
| \$                   |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Panel_Mfr        | char | 80.00  | 1.00 | -0-    | Name of panel fabrication org      |
| ATTRIBUTE ADD        | Panel_DOM        | char | 10.00  | 1.00 | -0-    | Panel date of manufacture          |
| ATTRIBUTE ADD        | Process_OutTime  | real | 1.00   | 1.00 | h      | Specific panel prepreg cum         |
| out-time             |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Tackifier_Lot    | char | 80.00  | 1.00 | -0-    | Tackifier mfr lot number           |
| ATTRIBUTE ADD        | Tackifier_DOM    | char | 10.00  | 1.00 | -0-    | Tackifier date of manufacture      |
| ATTRIBUTE ADD        | Process_Run_1_ID | char | 80.00  | 1.00 | -0-    | Specific panel cure/consol.        |
| run 1 ID             |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Process_Run_2_ID | char | 80.00  | 1.00 | -0-    | Specific panel cure/consol.        |
| run 2 ID             |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Process_Run_3_ID | char | 80.00  | 1.00 | -0-    | Specific panel cure/consol.        |
| run 3 ID             |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Process_OK       | char | 80.00  | 1.00 | -0-    | Process parameters satisfied?      |
| ATTRIBUTE ADD        | Panel_Cut_Method | char | 80.00  | 1.00 | -0-    | Panel cutting method               |
| ATTRIBUTE ADD        | NDE_Criterion    | char | 80.00  | 1.00 | -0-    | NDE criteria                       |
| ATTRIBUTE ADD        | NDE_Method       | char | 80.00  | 1.00 | -0-    | NDE method                         |
| ATTRIBUTE ADD        | NDE_Level        | char | 80.00  | 1.00 | -0-    | NDE level                          |
| ATTRIBUTE ADD        | NDE_Result       | char | 80.00  | 1.00 | -0-    | NDE result                         |
| ATTRIBUTE ADD        | NDE_Report       | char | 80.00  | 1.00 | -0-    | NDE results report                 |
| \$                   |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Panel_Thickness  | real | 1.00   | 1.00 | in     | Panel average total thickness      |
| ATTRIBUTE ADD        | Panel_RC         | real | 1.00   | 1.00 | Wt %   | Panel average resin/matrix content |
| ATTRIBUTE ADD        | Panel_Density    | real | 1.00   | 1.00 | Mg/m^3 | Panel average density              |
| ATTRIBUTE ADD        | Panel_Tg_Dry     | real | 1.00   | 1.00 | deg F  | Panel glass transition             |
| temperature          |                  |      |        |      |        |                                    |
| ATTRIBUTE ADD        | Panel_RC_TM      | char | 80.00  | 1.00 | -0-    | Panel resin content test method    |
| ATTRIBUTE ADD        | Panel_Vf_TM      | char | 80.00  | 1.00 | -0-    | Panel fiber volume test method     |
| ATTRIBUTE ADD        | Panel_Density_TM | char | 80.00  | 1.00 | -0-    | Panel density test method          |

TABLE 1. CONTINUED

|                 |                  |      |       |      |        |                                  |
|-----------------|------------------|------|-------|------|--------|----------------------------------|
| ATTRIBUTE ADD   | Panel_Tg_Dry_TM  | char | 80.00 | 1.00 | -0-    | Panel glass transition temp      |
| test method     |                  |      |       |      |        |                                  |
| \$ATTRIBUTE ADD | Core_Name        | char | 80.00 | 1.00 | -0-    | Sandwich core common name        |
| ATTRIBUTE ADD   | Core_Type        | char | 80.00 | 1.00 | -0-    | Sandwich core type               |
| ATTRIBUTE ADD   | Core_Mfr         | char | 80.00 | 1.00 | -0-    | Sandwich core manufacturer       |
| ATTRIBUTE ADD   | Core_Lot         | char | 80.00 | 1.00 | -0-    | Sandwich core lot number         |
| ATTRIBUTE ADD   | Core_Cell_Size   | real | 1.00  | 1.00 | in     | Sandwich core cell size          |
| ATTRIBUTE ADD   | Core_Cell_Shape  | char | 80.00 | 1.00 | -0-    | Sandwich core cell shape         |
| ATTRIBUTE ADD   | Core_Ribbon_Thk  | real | 1.00  | 1.00 | in     | Sandwich core ribbon thickness   |
| \$              |                  |      |       |      |        |                                  |
| ATTRIBUTE ADD   | Adhsv_Name       | char | 80.00 | 1.00 | -0-    | Adhesive name                    |
| ATTRIBUTE ADD   | Adhsv_Chem_Fam   | char | 80.00 | 1.00 | -0-    | Adhesive chemical family         |
| ATTRIBUTE ADD   | Adhsv_Mfr        | char | 80.00 | 1.00 | -0-    | Adhesive manufacturer            |
| ATTRIBUTE ADD   | Adhsv_Lot        | char | 80.00 | 1.00 | -0-    | Adhesive lot number              |
| ATTRIBUTE ADD   | Adhsv_DOM        | char | 10.00 | 1.00 | -0-    | Adhesive lot date of manufacture |
| ATTRIBUTE ADD   | Adhsv_Scrim      | char | 80.00 | 1.00 | -0-    | Adhesive scrim common name       |
| ATTRIBUTE ADD   | Adhsv_Scrim_Sty  | char | 80.00 | 1.00 | -0-    | Adhesive scrim fabric style      |
| ATTRIBUTE ADD   | Adhsv_Scrim_Szng | char | 80.00 | 1.00 | -0-    | Adhesive scrim sizing            |
| ATTRIBUTE ADD   | Adhsv_Surf_Prep  | char | 80.00 | 1.00 | -0-    | Adhesive surface preparation     |
| \$              |                  |      |       |      |        |                                  |
| \$              | Test             |      |       |      |        |                                  |
| \$              |                  |      |       |      |        |                                  |
| ATTRIBUTE ADD   | Test_Prop_Class  | char | 80.00 | 1.00 | -0-    | Test property class              |
| ATTRIBUTE ADD   | Test_Type        | char | 80.00 | 1.00 | -0-    | Test property type               |
| ATTRIBUTE ADD   | Test_Method      | char | 80.00 | 1.00 | -0-    | Test method                      |
| ATTRIBUTE ADD   | Test_Plan        | char | 80.00 | 1.00 | -0-    | Test plan document ID            |
| ATTRIBUTE ADD   | Test_Request_ID  | char | 80.00 | 1.00 | -0-    | Test request ID                  |
| ATTRIBUTE ADD   | Test_Report_ID   | char | 80.00 | 1.00 | -0-    | Test report ID                   |
| ATTRIBUTE ADD   | Test_Raw_Data_ID | char | 80.00 | 1.00 | -0-    | Test raw data ID                 |
| ATTRIBUTE ADD   | Test_Spec_Geom   | char | 80.00 | 1.00 | -0-    | Test specimen geometry           |
| ATTRIBUTE ADD   | Test_Parameter   | char | 80.00 | 1.00 | -0-    | Test parameter                   |
| ATTRIBUTE ADD   | Test_Facility    | char | 80.00 | 1.00 | -0-    | Test facility                    |
| ATTRIBUTE ADD   | Test_Eng_Name    | char | 80.00 | 1.00 | -0-    | Test engineer name               |
| ATTRIBUTE ADD   | Test_Eng_ID      | char | 80.00 | 1.00 | -0-    | Test engineer ID                 |
| ATTRIBUTE ADD   | Test_Tech_Name   | char | 80.00 | 1.00 | -0-    | Test technician name             |
| ATTRIBUTE ADD   | Test_Tech_ID     | char | 80.00 | 1.00 | -0-    | Test technician ID               |
| ATTRIBUTE ADD   | Test_Data_Source | char | 80.00 | 1.00 | -0-    | Test data source                 |
| ATTRIBUTE ADD   | Test_Machine_Mfr | char | 80.00 | 1.00 | -0-    | Test machine manufacturer &      |
| model           |                  |      |       |      |        |                                  |
| ATTRIBUTE ADD   | Test_Machine_SN  | char | 80.00 | 1.00 | -0-    | Test machine serial number       |
| ATTRIBUTE ADD   | Test_Fixture     | char | 80.00 | 1.00 | -0-    | Test fixture type                |
| ATTRIBUTE ADD   | Test_Fixture_Mfr | char | 80.00 | 1.00 | -0-    | Test fixture manufacturer        |
| ATTRIBUTE ADD   | Test_Fixture_SN  | char | 80.00 | 1.00 | -0-    | Test fixture serial number       |
| ATTRIBUTE ADD   | Test_Grip_Type   | char | 80.00 | 1.00 | -0-    | Test grip type                   |
| ATTRIBUTE ADD   | Test_Grip_Angle  | real | 1.00  | 1.00 | deg    | Test grip wedge angle            |
| ATTRIBUTE ADD   | Test_Grip_Surf   | char | 80.00 | 1.00 | -0-    | Test grip interface              |
| ATTRIBUTE ADD   | Test_Load_Type   | real | 1.00  | 1.00 | in     | Test loading type: 1/2, 1/3,     |
| 1/4 span        |                  |      |       |      |        |                                  |
| ATTRIBUTE ADD   | Test_Load_Radius | real | 1.00  | 1.00 | in     | Test loading nose radius         |
| ATTRIBUTE ADD   | Test_Supp_Span   | real | 1.00  | 1.00 | in     | Test support span                |
| ATTRIBUTE ADD   | Test_Supp_Radius | char | 80.00 | 1.00 | -0-    | Test support radius              |
| ATTRIBUTE ADD   | Test_Inst        | char | 80.00 | 1.00 | -0-    | Test instrumentation             |
| ATTRIBUTE ADD   | Test_DataAcqSys  | char | 80.00 | 1.00 | -0-    | Test data acquisition system     |
| ATTRIBUTE ADD   | Test_Ld_Cell_Mfr | char | 80.00 | 1.00 | -0-    | Test load cell manufacturer      |
| ATTRIBUTE ADD   | Test_Ld_Cell_SN  | char | 80.00 | 1.00 | -0-    | Test load cell serial number     |
| ATTRIBUTE ADD   | Test_Run_Number  | int  | 1.00  | 1.00 | -0-    | Test run number                  |
| \$              |                  |      |       |      |        |                                  |
| \$              | Coupon           |      |       |      |        |                                  |
| \$              | Coupon           |      |       |      |        |                                  |
| \$              | Tab              |      |       |      |        |                                  |
| \$              | Trans            |      |       |      |        |                                  |
| \$              | Test             |      |       |      |        |                                  |
| \$              |                  |      |       |      |        |                                  |
| ATTRIBUTE ADD   | Coupon_Orient    | real | 1.00  | 1.00 | deg    | Coupon nominal orientation       |
| ATTRIBUTE ADD   | Test_Modulus_Typ | char | 80.00 | 1.00 | -0-    | Test modulus type                |
| ATTRIBUTE ADD   | Test_OffsetValue | real | 1.00  | 1.00 | -0-    | Value of offset for offset       |
| strength        |                  |      |       |      |        |                                  |
| ATTRIBUTE ADD   | Coupon_Hole_Dia  | real | 1.00  | 1.00 | in     | Coupon nominal hole diameter     |
| ATTRIBUTE ADD   | Coupon_Bolt_Torq | real | 1.00  | 1.00 | in-lbf | Coupon nominal bolt torque       |
| ATTRIBUTE ADD   | Coupon_Byp_Ratio | real | 1.00  | 1.00 | -0-    | Coupon nominal bypass ratio      |
| ATTRIBUTE ADD   | Coupon_Grip_Len  | real | 1.00  | 1.00 | in     | Coupon nominal grip length       |
| ATTRIBUTE ADD   | Coupon_Thickness | real | 1.00  | 1.00 | in     | Coupon nominal thickness         |
| ATTRIBUTE ADD   | Coupon_Width     | real | 1.00  | 1.00 | in     | Coupon nominal width             |
| ATTRIBUTE ADD   | Coupon_Length    | real | 1.00  | 1.00 | in     | Coupon nominal length            |
| ATTRIBUTE ADD   | Coupon_Gage_Len  | real | 1.00  | 1.00 | in     | Coupon nominal gage length       |
| ATTRIBUTE ADD   | Coupon_Gage_Area | real | 1.00  | 1.00 | in^2   | Coupon nominal gage area         |

TABLE 1. CONTINUED

|                  |                  |      |       |      |       |  |
|------------------|------------------|------|-------|------|-------|--|
| ATTRIBUTE ADD    | Coupon_Notch_Rad | real | 1.00  | 1.00 | in    | Coupon nominal v-notch radius          |
| ATTRIBUTE ADD    | Coupon_Notch_Ang | real | 1.00  | 1.00 | deg   | Coupon nominal v-notch angle           |
| ATTRIBUTE ADD    | Coupon_Notch_Wid | real | 1.00  | 1.00 | in    | Coupon nominal v-notch width           |
| ATTRIBUTE ADD    | Coupon_SD_Ratio  | real | 1.00  | 1.00 | -0-   | Coupon nominal span/depth ratio        |
| ATTRIBUTE ADD    | Coupon_Crack_Len | real | 1.00  | 1.00 | in    | Coupon nominal initial crack length    |
| \$               |                  |      |       |      |       |  |
| ATTRIBUTE ADD    | Tab_Material     | char | 80.00 | 1.00 | -0-   | Coupon tabbing material                |
| ATTRIBUTE ADD    | Tab_Adhesive     | char | 80.00 | 1.00 | -0-   | Coupon tabbing adhesive                |
| ATTRIBUTE ADD    | Tab_Orientation  | real | 1.00  | 1.00 | deg   | Coupon nominal orientation             |
| ATTRIBUTE ADD    | Tab_Thickness    | real | 1.00  | 1.00 | in    | Coupon nominal tab material thk        |
| ATTRIBUTE ADD    | Tab_Angle        | real | 1.00  | 1.00 | deg   | Coupon nominal tab bevel angle         |
| ATTRIBUTE ADD    | Tab_Length       | real | 1.00  | 1.00 | in    | Coupon nominal tab length              |
| ATTRIBUTE ADD    | Tab_Cure_Temp    | real | 1.00  | 1.00 | deg F | Coupon nominal tab cure temp           |
| ATTRIBUTE ADD    | Tab_Cure_Time    | real | 1.00  | 1.00 | min   | Coupon nominal tab cure time           |
| \$               |                  |      |       |      |       |  |
| ATTRIBUTE ADD    | Coupon_Bolt_Type | char | 80.00 | 1.00 | -0-   | Coupon bolt/pin                        |
| spec/description |                  |      |       |      |       |  |
| ATTRIBUTE ADD    | Coupon_Bolt_Mat  | char | 80.00 | 1.00 | -0-   | Coupon bolt material                   |
| ATTRIBUTE ADD    | Coupon_Bolt_Dia  | real | 1.00  | 1.00 | in    | Coupon nominal bolt/pin diameter       |
| ATTRIBUTE ADD    | Trans_Type       | char | 80.00 | 1.00 | -0-   | Test transducer type                   |
| ATTRIBUTE ADD    | Trans_Class      | char | 80.00 | 1.00 | -0-   | Test transducer class                  |
| ATTRIBUTE ADD    | Trans_Mfr        | char | 80.00 | 1.00 | -0-   | Test transducer manufacturer           |
| ATTRIBUTE ADD    | Trans_Model      | char | 80.00 | 1.00 | -0-   | Test transducer model                  |
| ATTRIBUTE ADD    | Trans_Location   | char | 80.00 | 1.00 | -0-   | Test transducer coupon location        |
| ATTRIBUTE ADD    | Trans_Cure_Temp  | real | 1.00  | 1.00 | deg F | Test transducer cure temp              |
| ATTRIBUTE ADD    | Trans_Cure_Time  | real | 1.00  | 1.00 | min   | Test transducer cure time              |
| ATTRIBUTE ADD    | Test_DataAcqMthd | char | 80.00 | 1.00 | -0-   | Description of data acquisition method |
| ATTRIBUTE ADD    | Test_ModulusMthd | char | 80.00 | 1.00 | -0-   | Test modulus fit method                |
| ATTRIBUTE ADD    | Test_Modulus_Pt  | char | 80.00 | 1.00 | -0-   | Test modulus end-point unit            |
| ATTRIBUTE ADD    | Test_Modulus_Pt1 | real | 1.00  | 1.00 | -0-   | Test modulus nominal end point 1       |
| ATTRIBUTE ADD    | Test_Modulus_Pt2 | real | 1.00  | 1.00 | -0-   | Test modulus nominal end point 2       |
| ATTRIBUTE ADD    | Test_Poisson_Typ | char | 80.00 | 1.00 | -0-   | Test Poisson type                      |
| ATTRIBUTE ADD    | Test_PoissonMthd | char | 80.00 | 1.00 | -0-   | Test Poisson fit method                |
| ATTRIBUTE ADD    | Test_Poisson_Pt  | char | 80.00 | 1.00 | -0-   | Test Poisson end-point unit            |
| ATTRIBUTE ADD    | Test_Poisson_Pt1 | real | 1.00  | 1.00 | -0-   | Test Poisson end point 1               |
| ATTRIBUTE ADD    | Test_Poisson_Pt2 | real | 1.00  | 1.00 | -0-   | Test Poisson end point 2               |
| ATTRIBUTE ADD    | Test_Offset_Type | char | 1.00  | 1.00 | -0-   | Strain, stress, displacement           |
| ATTRIBUTE ADD    | Test_Offset_Unit | char | 1.00  | 1.00 | -0-   | Microstrain, ksi, inch                 |
| \$               |                  |      |       |      |       |  |
| \$               | Conditioning     |      |       |      |       |  |
| \$               | Cond             |      |       |      |       |  |
| \$               | Test             |      |       |      |       |  |
| \$               |                  |      |       |      |       |  |
| ATTRIBUTE ADD    | Test_Condition   | char | 80.00 | 1.00 | -0-   | Nominal material condition             |
| ATTRIBUTE ADD    | Test_Temperature | real | 1.00  | 1.00 | deg F | Nominal test temperature               |
| ATTRIBUTE ADD    | Test_Environment | char | 80.00 | 1.00 | -0-   | Test exposure environment              |
| \$               |                  |      |       |      |       |  |
| ATTRIBUTE ADD    | Cond_Env         | char | 80.00 | 1.00 | -0-   | Conditioning environment               |
| ATTRIBUTE ADD    | Cond_TM          | char | 80.00 | 1.00 | -0-   | Conditioning test method               |
| ATTRIBUTE ADD    | Cond_Step_1      | char | 80.00 | 1.00 | -0-   | Description of 1st condition step      |
| ATTRIBUTE ADD    | Cond_Temp_1      | real | 1.00  | 1.00 | deg F | Temperature of 1st condition step      |
| ATTRIBUTE ADD    | Cond_Medium_1    | char | 80.00 | 1.00 | -0-   | Description of 1st cond. step medium   |
| ATTRIBUTE ADD    | Cond_Medium_Val1 | real | 1.00  | 1.00 | -0-   | Measure of Medium 1                    |
| ATTRIBUTE ADD    | Cond_Time_1      | real | 1.00  | 1.00 | day   | Time of exposure during Step 1         |
| ATTRIBUTE ADD    | Cond_Step_2      | char | 80.00 | 1.00 | -0-   | Description of 2nd condition step      |
| ATTRIBUTE ADD    | Cond_Temp_2      | real | 1.00  | 1.00 | deg F | Temperature of 2nd condition step      |
| ATTRIBUTE ADD    | Cond_Medium_2    | char | 80.00 | 1.00 | -0-   | Description of 2nd cond. step medium   |
| ATTRIBUTE ADD    | Cond_Medium_Val2 | real | 1.00  | 1.00 | -0-   | Measure of Medium 2                    |
| ATTRIBUTE ADD    | Cond_Time_2      | real | 1.00  | 1.00 | day   | Time of exposure during Step 2         |
| ATTRIBUTE ADD    | Cond_Trav_Geom   | char | 80.00 | 1.00 | -0-   | Geometry of conditioning traveler      |
| ATTRIBUTE ADD    | Cond_Eq_Crit     | char | 80.00 | 1.00 | -0-   | Criterion for equilibrium              |
| ATTRIBUTE ADD    | Cond_Mi_Initial  | real | 1.00  | 1.00 | Wt %  | Initial moisture content               |



TABLE 1. CONTINUED

|               |                  |      |       |      |               |  |
|---------------|------------------|------|-------|------|---------------|--|
| ATTRIBUTE ADD | Cond_Mi_Final    | real | 1.00  | 1.00 | Wt %          | Final moisture gain                    |
| ATTRIBUTE ADD | Cond_Mi_Total    | real | 1.00  | 1.00 | Wt %          | Total moisture content                 |
| \$            |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Test_Heatup_Time | real | 1.00  | 1.00 | min           | Test heat-up time                      |
| ATTRIBUTE ADD | Test_Dwell_Time  | real | 1.00  | 1.00 | min           | Test dwell time at                     |
| temperature   |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Test_Dryout      | real | 1.00  | 1.00 | Wt %          | Moisture loss during test              |
| \$            |                  |      |       |      |               |  |
| \$            | Actuals          |      |       |      |               |  |
| \$            | Mechanical       |      |       |      |               |  |
| \$            | Hygrothermal     |      |       |      |               |  |
| \$            |                  |      |       |      |               |  |
| ATTRIBUTE ADD | ID_of_Coupon     | char | 80.00 | 1.00 | -0-           | Label on Coupon                        |
| ATTRIBUTE ADD | Valid_IAW_TM     | char | 10.00 | 1.00 | -0-           | Test valid IAW test method?            |
| ATTRIBUTE ADD | Failure_Mode     | char | 80.00 | 1.00 | -0-           | Failure mode code or                   |
| description   |                  |      |       |      |               |  |
| \$            |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Thickness        | real | 1.00  | 1.00 | in            | Actual coupon thickness                |
| ATTRIBUTE ADD | Length           | real | 1.00  | 1.00 | in            | Actual coupon length                   |
| ATTRIBUTE ADD | Width            | real | 1.00  | 1.00 | in            | Actual coupon width                    |
| ATTRIBUTE ADD | Gage_Length      | real | 1.00  | 1.00 | in            | Actual gage length                     |
|               |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Gage_Width       | real | 1.00  | 1.00 | in            | Actual gage width                      |
| ATTRIBUTE ADD | Gage_Area        | real | 1.00  | 1.00 | in^2          | Actual gage cross-section area         |
| ATTRIBUTE ADD | Area_Calc_Method | char | 80.00 | 1.00 | -0-           | Coupon gage cross-section              |
| area method   |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Edge_Dist_Ratio  | real | 1.00  | 1.00 | -0-           | Actual edge distance ratio             |
| ATTRIBUTE ADD | Edge_Distance    | real | 1.00  | 1.00 | in            | Actual edge distance                   |
| ATTRIBUTE ADD | Hole_Diameter    | real | 1.00  | 1.00 | in            | Actual hole diameter                   |
| ATTRIBUTE ADD | Notch_Length     | real | 1.00  | 1.00 | in            | Length between notches                 |
| ATTRIBUTE ADD | Notch_Depth1     | real | 1.00  | 1.00 | in            | Notch Depth 1 of CILS coupon           |
| ATTRIBUTE ADD | Notch_Depth2     | real | 1.00  | 1.00 | in            | Notch Depth 2 of CILS coupon           |
| ATTRIBUTE ADD | Overlap          | real | 1.00  | 1.00 | in            | Overlap between notches of CILS coupon |
| ATTRIBUTE ADD | Sandwich_Thk     | real | 1.00  | 1.00 | in            | Actual sandwich thickness              |
| ATTRIBUTE ADD | Core_Thickness   | real | 1.00  | 1.00 | in            | Actual thickness of sandwich           |
| core          |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Opposite_FS_Thk  | real | 1.00  | 1.00 | in            | Actual thk of opp. sandwich            |
| facesheet     |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Impactor_Type    | char | 80.00 | 1.00 | -0-           | Type of Impactor                       |
| ATTRIBUTE ADD | Impact_Energy    | real | 1.00  | 1.00 | in-lbf        | Actual impact energy                   |
| ATTRIBUTE ADD | Absorb_Energy    | real | 1.00  | 1.00 | in-lbf        | Total energy absorbed during           |
| impact        |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Impactor_Dia     | real | 1.00  | 1.00 | in            | Actual diameter of impactor            |
| ATTRIBUTE ADD | Impact_Fmax      | real | 1.00  | 1.00 | lbf           | Maximum impact force                   |
| ATTRIBUTE ADD | Impact_Mass      | real | 1.00  | 1.00 | lbf           | Weight of impact tup                   |
| ATTRIBUTE ADD | Impact_Vel       | real | 1.00  | 1.00 | ft/s          | Impact velocity                        |
| ATTRIBUTE ADD | Impact_Number    | char | 80.00 | 1.00 | -0-           | Identification of impact event         |
| ATTRIBUTE ADD | Damaged_Area     | real | 1.00  | 1.00 | in^2          | Size of damaged area due to            |
| impact        |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Dent_Depth       | real | 1.00  | 1.00 | in            | Dent depth                             |
| ATTRIBUTE ADD | Displ_Fmax       | real | 1.00  | 1.00 | in            | Displacement at max. impact force      |
| ATTRIBUTE ADD | Extensometer_Len | real | 1.00  | 1.00 | in            | Actual extensometer gage               |
| length        |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Bolt_Diameter    | real | 1.00  | 1.00 | in            | Actual bolt/pin diameter               |
| ATTRIBUTE ADD | Torque           | real | 1.00  | 1.00 | lbf-in        | Actual bolt torque                     |
| ATTRIBUTE ADD | Load_Ratio       | real | 1.00  | 1.00 | -0-           | Actual load ratio                      |
| ATTRIBUTE ADD | Frequency        | real | 1.00  | 1.00 | Hz            | Actual loading frequency               |
| ATTRIBUTE ADD | Stress_Ratio     | real | 1.00  | 1.00 | -0-           | Actual stress ratio                    |
| ATTRIBUTE ADD | Load_Mean        | real | 1.00  | 1.00 | lbf           | Actual mean cyclic load                |
| ATTRIBUTE ADD | Stress_Mean      | real | 1.00  | 1.00 | ksi           | Actual mean cyclic stress              |
| ATTRIBUTE ADD | Strain_Mean      | real | 1.00  | 1.00 | microstrain   | Actual mean cyclic strain              |
| ATTRIBUTE ADD | Start_Date       | char | 10.00 | 1.00 | -0-           | Start of testing                       |
| ATTRIBUTE ADD | End_Date         | char | 10.00 | 1.00 | -0-           | End of testing                         |
| ATTRIBUTE ADD | Grip_Pressure    | real | 1.00  | 1.00 | psi           | Hydraulic/pneumatic grip               |
| pressure      |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Preload          | real | 1.00  | 1.00 | lbf           | Preload on coupon                      |
| ATTRIBUTE ADD | Control_Method   | char | 80.00 | 1.00 | -0-           | Method of controlling test             |
| ATTRIBUTE ADD | Speed_of_Test    | real | 1.00  | 1.00 | in/min        | Rate of test                           |
| ATTRIBUTE ADD | Strain_Rate      | real | 1.00  | 1.00 | microstrain/s | Nominal initial strain                 |
| rate          |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Data_Acq_Rate    | real | 1.00  | 1.00 | Hz            | Data acquisition sampling rate         |
| ATTRIBUTE ADD | Bending_Checked  | char | 80.00 | 1.00 | -0-           | Was bending strain checked?            |
| ATTRIBUTE ADD | Bending_Strm_Pt1 | real | 1.00  | 1.00 | microstrain   | Mean strain point                      |
| for Bending 1 |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Bending_Strm_Pt2 | real | 1.00  | 1.00 | microstrain   | Mean strain point                      |
| for Bending 2 |                  |      |       |      |               |  |
| ATTRIBUTE ADD | Bending_Pt1      | real | 1.00  | 1.00 | %             | Bending level at point 1               |

TABLE 1. CONTINUED

|               |   |      |        |      |             |  |
|---------------|---|------|--------|------|-------------|--|
| ATTRIBUTE ADD | Bending_Pt2                                   | real | 1.00   | 1.00 | %           | Bending level at point 2               |
| \$            |   |      |        |      |             |  |
| ATTRIBUTE ADD | Load_Max                                      | real | 1.00   | 1.00 | lbf         | Actual max load during test            |
| ATTRIBUTE ADD | Load_Audible                                  | real | 1.00   | 1.00 | lbf         | Load when first audible event occurred |
| ATTRIBUTE ADD | Disp_Max                                      | real | 1.00   | 1.00 | in          | Actual max displ/defl during test      |
| ATTRIBUTE ADD | Failure_Location                              | char | 80.00  | 1.00 | -0-         | Failure location                       |
| ATTRIBUTE ADD | Cycles_at_Finish                              | int  | 1.00   | 1.00 | -0-         | Cycles at test termination             |
| ATTRIBUTE ADD | Test_Term_Crit                                | char | 80.00  | 1.00 | -0-         | Test termination criterion             |
| ATTRIBUTE ADD | Max_Stress_Eq_F                               | char | 3.00   | 1.00 | -0-         | Did maximum stress = strength?         |
| ATTRIBUTE ADD | Note_1  | char | 700.00 | 1.00 | -0-         | A first note about this test           |
| ATTRIBUTE ADD | Note_2  | char | 700.00 | 1.00 | -0-         | A second note about this test          |
| ATTRIBUTE ADD | Note_3  | char | 700.00 | 1.00 | -0-         | A third note about this test           |
| \$            |   |      |        |      |             |  |
| \$            | Mechanical Relation Property Table            |      |        |      |             |  |
| \$            | Lamina Tensile Properties (1 - Direction)     |      |        |      |             |  |
| \$            |   |      |        |      |             |  |
| ATTRIBUTE ADD | F1tu  | real | 1.00   | 1.00 | ksi         | Ultimate Tensile Strength (1-Dir)      |
| ATTRIBUTE ADD | e1tu  | real | 1.00   | 1.00 | microstrain | Ultimate Tensile Strain (1-Dir)        |
| ATTRIBUTE ADD | E1t   | real | 1.00   | 1.00 | msi         | Tensile Elastic Modulus (1-Dir)        |
| ATTRIBUTE ADD | nu12t   | real | 1.00   | 1.00 | -0-         | Tensile Poisson's Ratio (12-Dir)       |
| ATTRIBUTE ADD | nu13t   | real | 1.00   | 1.00 | -0-         | Tensile Poisson's Ratio (13-Dir)       |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Compressive Properties (1 - Direction) |      |        |      |             |  |
| ATTRIBUTE ADD | F1cu  | real | 1.00   | 1.00 | ksi         | Ultimate Compressive Strength (1-Dir)  |
| ATTRIBUTE ADD | e1cu  | real | 1.00   | 1.00 | microstrain | Ultimate Compressive Strain            |
| ATTRIBUTE ADD | E1c   | real | 1.00   | 1.00 | msi         | Compressive Elastic Modulus (1-Dir)    |
| ATTRIBUTE ADD | nu12c   | real | 1.00   | 1.00 | -0-         | Compressive Poisson's Ratio (12-Dir)   |
| ATTRIBUTE ADD | nu13c   | real | 1.00   | 1.00 | -0-         | Compressive Poisson's Ratio (13-Dir)   |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Tensile Properties (2 - Direction)     |      |        |      |             |  |
| ATTRIBUTE ADD | F2tu  | real | 1.00   | 1.00 | ksi         | Ultimate Tensile Strength (2-Dir)      |
| ATTRIBUTE ADD | e2tu  | real | 1.00   | 1.00 | microstrain | Ultimate Tensile Strain (2-Dir)        |
| ATTRIBUTE ADD | E2t   | real | 1.00   | 1.00 | msi         | Tensile Elastic Modulus (2-Dir)        |
| ATTRIBUTE ADD | nu21t   | real | 1.00   | 1.00 | -0-         | Tensile Poisson's Ratio (21-Dir)       |
| ATTRIBUTE ADD | nu23t   | real | 1.00   | 1.00 | -0-         | Tensile Poisson's Ratio (23-Dir)       |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Compressive Properties (2 - Direction) |      |        |      |             |  |
| ATTRIBUTE ADD | F2cu  | real | 1.00   | 1.00 | ksi         | Ultimate Compressive Strength (2-Dir)  |
| ATTRIBUTE ADD | e2cu  | real | 1.00   | 1.00 | microstrain | Ultimate Compressive Strain            |
| ATTRIBUTE ADD | E2c   | real | 1.00   | 1.00 | msi         | Compressive Elastic Modulus (2-Dir)    |
| ATTRIBUTE ADD | nu21c   | real | 1.00   | 1.00 | -0-         | Compressive Poisson's Ratio (21-Dir)   |
| ATTRIBUTE ADD | nu23c   | real | 1.00   | 1.00 | -0-         | Compressive Poisson's Ratio (23-Dir)   |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Shear Properties (12 - Direction)      |      |        |      |             |  |
| ATTRIBUTE ADD | F12su   | real | 1.00   | 1.00 | ksi         | Ultimate Shear Strength (12-Dir)       |
| ATTRIBUTE ADD | F12so   | real | 1.00   | 1.00 | ksi         | Offset Shear Strength (12-Dir)         |
| ATTRIBUTE ADD | e12su   | real | 1.00   | 1.00 | microstrain | Ultimate Shear Strain (12-Dir)         |
| ATTRIBUTE ADD | e12so   | real | 1.00   | 1.00 | microstrain | Offset Shear Strain (12-Dir)           |
| ATTRIBUTE ADD | G12   | real | 1.00   | 1.00 | msi         | Shear Elastic Modulus (12-Dir)         |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Tensile Properties (3 - Direction)     |      |        |      |             |  |
| ATTRIBUTE ADD | F3tu  | real | 1.00   | 1.00 | ksi         | Ultimate Tensile Strength (3-Dir)      |
| ATTRIBUTE ADD | e3tu  | real | 1.00   | 1.00 | microstrain | Ultimate Tensile Strain (3-Dir)        |
| ATTRIBUTE ADD | E3t   | real | 1.00   | 1.00 | msi         | Tensile Elastic Modulus (3-Dir)        |
| ATTRIBUTE ADD | nu31t   | real | 1.00   | 1.00 | -0-         | Tensile Poisson's Ratio (31-Dir)       |
| ATTRIBUTE ADD | nu32t   | real | 1.00   | 1.00 | -0-         | Tensile Poisson's Ratio (32-Dir)       |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Compressive Properties (3 - Direction) |      |        |      |             |  |
| ATTRIBUTE ADD | F3cu  | real | 1.00   | 1.00 | ksi         | Ultimate Compressive Strength (3-Dir)  |
| ATTRIBUTE ADD | e3cu  | real | 1.00   | 1.00 | microstrain | Ultimate Compressive Strain            |
| ATTRIBUTE ADD | E3c   | real | 1.00   | 1.00 | msi         | Compressive Elastic Modulus (3-Dir)    |
| ATTRIBUTE ADD | nu31c   | real | 1.00   | 1.00 | -0-         | Compressive Poisson's Ratio (31-Dir)   |
| ATTRIBUTE ADD | nu32c   | real | 1.00   | 1.00 | -0-         | Compressive Poisson's Ratio (32-Dir)   |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Shear Properties (23 - Direction)      |      |        |      |             |  |
| ATTRIBUTE ADD | F23su   | real | 1.00   | 1.00 | ksi         | Ultimate Shear Strength (23-Dir)       |
| ATTRIBUTE ADD | F23so   | real | 1.00   | 1.00 | ksi         | Offset Shear Strength (23-Dir)         |
| ATTRIBUTE ADD | e23su   | real | 1.00   | 1.00 | microstrain | Ultimate Shear Strain (23-Dir)         |
| ATTRIBUTE ADD | e23so   | real | 1.00   | 1.00 | microstrain | Offset Shear Strain (23-Dir)           |
| ATTRIBUTE ADD | G23   | real | 1.00   | 1.00 | msi         | Shear Elastic Modulus (23-Dir)         |
| \$            |   |      |        |      |             |  |
| \$            | Lamina Shear Properties (31 - Direction)      |      |        |      |             |  |

TABLE 1. CONTINUED

|                              |  |      |      |      |             |                                       |
|------------------------------|--|------|------|------|-------------|---------------------------------------|
| ATTRIBUTE ADD                | F31su  | real | 1.00 | 1.00 | ksi         | Ultimate Shear Strength (31-Dir)"     |
| -0-                          |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | F31so  | real | 1.00 | 1.00 | ksi         | Offset Shear Strength (31-Dir)"       |
| -0-                          |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | e31su  | real | 1.00 | 1.00 | microstrain | Ultimate Shear Strain (31-Dir)        |
| ATTRIBUTE ADD                | e31so  | real | 1.00 | 1.00 | microstrain | Offset Shear Strain (31-Dir)          |
| ATTRIBUTE ADD                | G31  | real | 1.00 | 1.00 | msi         | Shear Elastic Modulus (31-Dir)        |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Tensile Properties (x - Direction)                                |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fxtu   | real | 1.00 | 1.00 | ksi         | Ultimate Tensile Strength (x-Dir)     |
| ATTRIBUTE ADD                | extu   | real | 1.00 | 1.00 | microstrain | Ultimate Tensile Strain (x-Dir)       |
| ATTRIBUTE ADD                | Ext  | real | 1.00 | 1.00 | msi         | Tensile Elastic Modulus (x-Dir)       |
| ATTRIBUTE ADD                | nuxyt  | real | 1.00 | 1.00 | -0-         | Tensile Poisson's Ratio (xy-Dir)      |
| ATTRIBUTE ADD                | nuxzt  | real | 1.00 | 1.00 | -0-         | Tensile Poisson's Ratio (xz-Dir)      |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Compressive Properties (x - Direction)                            |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fxcu   | real | 1.00 | 1.00 | ksi         | Ultimate Compressive Strength (x-Dir) |
| ATTRIBUTE ADD                | excu   | real | 1.00 | 1.00 | microstrain | Ultimate Compressive Strain           |
| (x-Dir)                      |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Exc  | real | 1.00 | 1.00 | msi         | Compressive Elastic Modulus (x-Dir)   |
| ATTRIBUTE ADD                | nuxyc  | real | 1.00 | 1.00 | -0-         | Compressive Poisson's Ratio (xy-Dir)  |
| ATTRIBUTE ADD                | nuxzc  | real | 1.00 | 1.00 | -0-         | Compressive Poisson's Ratio (xz-Dir)  |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Tensile Properties (y - Direction)                                |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fytu   | real | 1.00 | 1.00 | ksi         | Ultimate Tensile Strength (y-Dir)     |
| ATTRIBUTE ADD                | eytu   | real | 1.00 | 1.00 | microstrain | Ultimate Tensile Strain (y-Dir)       |
| ATTRIBUTE ADD                | Eyt  | real | 1.00 | 1.00 | msi         | Tensile Elastic Modulus (y-Dir)       |
| ATTRIBUTE ADD                | nuyxt  | real | 1.00 | 1.00 | -0-         | Tensile Poisson's Ratio (yx-Dir)      |
| ATTRIBUTE ADD                | nuyzt  | real | 1.00 | 1.00 | -0-         | Tensile Poisson's Ratio (yz-Dir)      |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Compressive Properties (y - Direction)                            |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fycu   | real | 1.00 | 1.00 | ksi         | Ultimate Compressive Strength (y-Dir) |
| ATTRIBUTE ADD                | eycu   | real | 1.00 | 1.00 | microstrain | Ultimate Compressive Strain           |
| (y-Dir)                      |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Eyc  | real | 1.00 | 1.00 | msi         | Compressive Elastic Modulus (y-Dir)   |
| ATTRIBUTE ADD                | nuyxc  | real | 1.00 | 1.00 | -0-         | Compressive Poisson's Ratio (yx-Dir)  |
| ATTRIBUTE ADD                | nuyzc  | real | 1.00 | 1.00 | -0-         | Compressive Poisson's Ratio (yz-Dir)  |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Shear Properties (xy - Direction)                                 |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fxysu  | real | 1.00 | 1.00 | ksi         | Ultimate Shear Strength (xy-Dir)      |
| ATTRIBUTE ADD                | exysu  | real | 1.00 | 1.00 | microstrain | Ultimate Shear Strain (xy-Dir)        |
| ATTRIBUTE ADD                | Gxy  | real | 1.00 | 1.00 | msi         | Shear Elastic Modulus (xy-Dir)        |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Tensile Properties (z - Direction)                                |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fzsu   | real | 1.00 | 1.00 | ksi         | Ultimate Tensile Strength (z-Dir)     |
| ATTRIBUTE ADD                | eztu   | real | 1.00 | 1.00 | microstrain | Ultimate Tensile Strain (z-Dir)       |
| ATTRIBUTE ADD                | Ezt  | real | 1.00 | 1.00 | msi         | Tensile Elastic Modulus (z-Dir)       |
| ATTRIBUTE ADD                | nuzxt  | real | 1.00 | 1.00 | -0-         | Tensile Poisson's Ratio (zx-Dir)      |
| ATTRIBUTE ADD                | nuzyt  | real | 1.00 | 1.00 | -0-         | Tensile Poisson's Ratio (zy-Dir)      |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Compressive Properties (z - Direction)                            |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fzcu   | real | 1.00 | 1.00 | ksi         | Ultimate Compressive Strength (z-Dir) |
| ATTRIBUTE ADD                | ezcu   | real | 1.00 | 1.00 | microstrain | Ultimate Compressive Strain           |
| (z-Dir)                      |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Ezc  | real | 1.00 | 1.00 | msi         | Compressive Elastic Modulus (z-Dir)   |
| ATTRIBUTE ADD                | nuzxc  | real | 1.00 | 1.00 | -0-         | Compressive Poisson's Ratio (zx-Dir)  |
| ATTRIBUTE ADD                | nuzyc  | real | 1.00 | 1.00 | -0-         | Compressive Poisson's Ratio (zy-Dir)  |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Shear Properties (zy - Direction)                                 |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fzysu  | real | 1.00 | 1.00 | ksi         | Ultimate Shear Strength (zy-Dir)      |
| ATTRIBUTE ADD                | ezysu  | real | 1.00 | 1.00 | microstrain | Ultimate Shear Strain (zy-Dir)        |
| ATTRIBUTE ADD                | Gzy  | real | 1.00 | 1.00 | msi         | Shear Elastic Modulus (zy-Dir)        |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Shear Properties (zx - Direction)                                 |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Fzxsu  | real | 1.00 | 1.00 | ksi         | Ultimate Shear Strength (zx-Dir)      |
| ATTRIBUTE ADD                | ezxsu  | real | 1.00 | 1.00 | microstrain | Ultimate Shear Strain (zx-Dir)        |
| ATTRIBUTE ADD                | Gzx  | real | 1.00 | 1.00 | msi         | Shear Elastic Modulus (zx-Dir)        |
| \$                           |  |      |      |      |             |                                       |
| \$                           | Laminate Structural Properties, SBS, CAI, Open Hole, Filled Hole, Fracture |      |      |      |             |                                       |
| Toughness and Bearing/Bypass |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Exten_Strain1  | real | 1.00 | 1.00 | microstrain | Meas. strain from                     |
| extensometer 1               |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Exten_Strain2  | real | 1.00 | 1.00 | microstrain | Meas. strain from                     |
| extensometer 2               |  |      |      |      |             |                                       |
| ATTRIBUTE ADD                | Gage_Strain1   | real | 1.00 | 1.00 | microstrain | Meas. strain from gage 1              |
| ATTRIBUTE ADD                | Gage_Strain2   | real | 1.00 | 1.00 | microstrain | Meas. strain from gage 2              |
| ATTRIBUTE ADD                | Exten_Mod1   | real | 1.00 | 1.00 | msi         | Meas. modulus from extensometer 1     |

TABLE 1. CONTINUED

|  |                  |      |      |      |                   |  |
|--|------------------|------|------|------|-------------------|--|
| ATTRIBUTE ADD                                | Exten_Mod2       | real | 1.00 | 1.00 | msi               | Meas. modulus from extensometer 2                |
| ATTRIBUTE ADD                                | Gage_Mod1        | real | 1.00 | 1.00 | msi               | Meas. modulus from gage 1                        |
| ATTRIBUTE ADD                                | Gage_Mod2        | real | 1.00 | 1.00 | msi               | Meas. modulus from gage 2                        |
| ATTRIBUTE ADD                                | Trans_Strain     | real | 1.00 | 1.00 | microstrain       | Meas. transverse strain                          |
| ATTRIBUTE ADD                                | Fsbs             | real | 1.00 | 1.00 | ksi               | Short beam strength                              |
| ATTRIBUTE ADD                                | Fils             | real | 1.00 | 1.00 | ksi               | Compression Coupon ILS                           |
| ATTRIBUTE ADD                                | Filt             | real | 1.00 | 1.00 | ksi               | Interlaminar Tension Strength                    |
| ATTRIBUTE ADD                                | Fcai             | real | 1.00 | 1.00 | ksi               | Compression-after-impact strength                |
| ATTRIBUTE ADD                                | ecai             | real | 1.00 | 1.00 | microstrain       | Compressive-after-impact strain                  |
| ATTRIBUTE ADD                                | Ftai             | real | 1.00 | 1.00 | ksi               | Tension-after-impact strength                    |
| ATTRIBUTE ADD                                | etai             | real | 1.00 | 1.00 | microstrain       | Tension-after-impact strain                      |
| ATTRIBUTE ADD                                | Fohc             | real | 1.00 | 1.00 | ksi               | Open hole compressive strength                   |
| ATTRIBUTE ADD                                | eohe             | real | 1.00 | 1.00 | microstrain       | Open hole compressive strain                     |
| ATTRIBUTE ADD                                | Foht             | real | 1.00 | 1.00 | ksi               | Openhole tensile strength                        |
| ATTRIBUTE ADD                                | eoht             | real | 1.00 | 1.00 | microstrain       | Open hole tensile strain                         |
| ATTRIBUTE ADD                                | Ffhc             | real | 1.00 | 1.00 | ksi               | Filled hole compressive strength                 |
| ATTRIBUTE ADD                                | Ffht             | real | 1.00 | 1.00 | ksi               | Filled hole tension strength                     |
| ATTRIBUTE ADD                                | Axial_Stress     | real | 1.00 | 1.00 | ksi               | Biaxial test axial stress                        |
| ATTRIBUTE ADD                                | Hoop_Stress      | real | 1.00 | 1.00 | ksi               | Biaxial test hoop stress                         |
| ATTRIBUTE ADD                                | Axial_Strain     | real | 1.00 | 1.00 | microstrain       | Biaxial test axial strain                        |
| ATTRIBUTE ADD                                | Hoop_Strain      | real | 1.00 | 1.00 | microstrain       | Biaxial test hoop strain                         |
| ATTRIBUTE ADD                                | Braid_Strain     | real | 1.00 | 1.00 | microstrain       | Biaxial test braid strain                        |
| ATTRIBUTE ADD                                | GIC_Area_Method  | real | 1.00 | 1.00 | in-lbs/in^2       | Fracture toughness mode I with area method       |
| ATTRIBUTE ADD                                | GIC_Init_Method  | real | 1.00 | 1.00 | in-lbs/in^2       | Fracture toughness mode I with initiation method |
| ATTRIBUTE ADD                                | GIIC             | real | 1.00 | 1.00 | in-lbs/in^2       | Fracture toughness mode II                       |
| ATTRIBUTE ADD                                | Fbr              | real | 1.00 | 1.00 | ksi               | Bearing ultimate strength                        |
| ATTRIBUTE ADD                                | Fbro             | real | 1.00 | 1.00 | ksi               | Bearing offset strength                          |
| ATTRIBUTE ADD                                | ebr              | real | 1.00 | 1.00 | microstrain       | Bearing ultimate strain                          |
| ATTRIBUTE ADD                                | Fbyp             | real | 1.00 | 1.00 | ksi               | Bypass ultimate strength                         |
| ATTRIBUTE ADD                                | Fbypo            | real | 1.00 | 1.00 | ksi               | Bypass offset strength                           |
| ATTRIBUTE ADD                                | ebyp             | real | 1.00 | 1.00 | microstrain       | Bypass ultimate strain                           |
| ATTRIBUTE ADD                                | Pbru             | real | 1.00 | 1.00 | lbf               | Bearing ultimate load                            |
| ATTRIBUTE ADD                                | Pbro             | real | 1.00 | 1.00 | lbf               | Bearing offset load                              |
| ATTRIBUTE ADD                                | Pbypu            | real | 1.00 | 1.00 | lbf               | Bypass ultimate load                             |
| ATTRIBUTE ADD                                | Pbypo            | real | 1.00 | 1.00 | lbf               | Bypass offset load                               |
| ATTRIBUTE ADD                                | Temperature_Lab  | real | 1.00 | 1.00 | deg F             | Actual laboratory temperature                    |
| ATTRIBUTE ADD                                | RH_Lab           | real | 1.00 | 1.00 | %RH               | Actual laboratory relative humidity              |
| ATTRIBUTE ADD                                | Temperature_Test | real | 1.00 | 1.00 | deg F             | Actual test temperature                          |
| ATTRIBUTE ADD                                | RH_Test          | real | 1.00 | 1.00 | %RH               | Actual test relative humidity                    |
| \$   |                  |      |      |      |                   |  |
| \$ Graphical Test Data (Mechanical Lamina)   |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F1_tVSe1_t       | real | 3.00 | 0.00 | microstrain ; ksi | Tensile Strain                                   |
| (1-Dir) ; Tensile Stress (1-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F1_cVSe1_c       | real | 3.00 | 0.00 | microstrain ; ksi | Compressive Strain                               |
| (1-Dir) ; Compressive Stress (1-Dir)         |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F2_tVSe2_t       | real | 3.00 | 0.00 | microstrain ; ksi | Tensile Strain                                   |
| (2-Dir) ; Tensile Stress (2-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F2_cVSe2_c       | real | 3.00 | 0.00 | microstrain ; ksi | Compressive Strain                               |
| (2-Dir) ; Compressive Stress (2-Dir)         |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F12_sVSe12_s     | real | 3.00 | 0.00 | microstrain ; ksi | Shear Strain                                     |
| (12-Dir) ; Shear Stress (12-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F3_tVSe3_t       | real | 3.00 | 0.00 | microstrain ; ksi | Tensile Strain                                   |
| (3-Dir) ; Tensile Stress (3-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F3_cVSe3_c       | real | 3.00 | 0.00 | microstrain ; ksi | Compressive Strain                               |
| (3-Dir) ; Compressive Stress (3-Dir)         |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F23_sVSe23_s     | real | 3.00 | 0.00 | microstrain ; ksi | Shear Strain                                     |
| (23-Dir) ; Shear Stress (23-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | F31_sVSe31_s     | real | 3.00 | 0.00 | microstrain ; ksi | Shear Strain                                     |
| (13-Dir) ; Shear Stress (13-Dir)             |                  |      |      |      |                   |  |
| \$   |                  |      |      |      |                   |  |
| \$ Graphical Test Data (Mechanical Laminate) |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | Fx_tVSeX_t       | real | 3.00 | 0.00 | microstrain ; ksi | Tensile Strain                                   |
| (x-Dir) ; Tensile Stress (x-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | Fx_cVSeX_c       | real | 3.00 | 0.00 | microstrain ; ksi | Compressive Strain                               |
| (x-Dir) ; Compressive Stress (x-Dir)         |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | Fy_tVSeY_t       | real | 3.00 | 0.00 | microstrain ; ksi | Tensile Strain                                   |
| (y-Dir) ; Tensile Stress (y-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | Fy_cVSeY_c       | real | 3.00 | 0.00 | microstrain ; ksi | Compressive Strain                               |
| (y-Dir) ; Compressive Stress (y-Dir)         |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | Fxy_sVSeXY_s     | real | 3.00 | 0.00 | microstrain ; ksi | Shear Strain                                     |
| (xy-Dir) ; Shear Stress (xy-Dir)             |                  |      |      |      |                   |  |
| ATTRIBUTE ADD                                | Fz_tVSeZ_t       | real | 3.00 | 0.00 | microstrain ; ksi | Tensile Strain                                   |

TABLE 1. CONTINUED

|   |                  |      |      |      |                   |                                       |
|---|------------------|------|------|------|-------------------|---------------------------------------|
| (z-Dir) ; Tensile Stress (z-Dir)                  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | Fz_vSez_c        | real | 3.00 | 0.00 | microstrain ; ksi | Compressive Strain                    |
| (z-Dir) ; Compressive Stress (z-Dir)              |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | Fzy_sVSezy_s     | real | 3.00 | 0.00 | microstrain ; ksi | Shear Strain                          |
| (zy-Dir) ; Shear Stress (zy-Dir)                  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | Fzx_sVSezx_s     | real | 3.00 | 0.00 | microstrain ; ksi | Shear Strain                          |
| (zx-Dir) ; Shear Stress (zx-Dir)                  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | F_ohcVSe_ohc     | real | 3.00 | 0.00 | microstrain ; ksi | Open Hole                             |
| Compressive Strain ; Open Hole Compressive Stress |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | F_ohcVSe_ohc     | real | 3.00 | 0.00 | microstrain ; ksi | Open Hole Tensile                     |
| Strain ; Open Hole Tensile Stress                 |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | F_brVSe_br       | real | 3.00 | 0.00 | microstrain ; ksi | Bearing Strain ;                      |
| Bearing Stress                                    |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | F_brVSDisp_br    | real | 3.00 | 0.00 | in ; ksi          | Bearing Displacement ;                |
| Bearing Stress                                    |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | F_briniVSDisp_br | real | 3.00 | 0.00 | in ; ksi          | Bearing Displacement ;                |
| Initial Bearing Stress                            |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | F_broffVSDisp_br | real | 3.00 | 0.00 | in ; ksi          | Bearing Displacement ;                |
| Offset Bearing Stress                             |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | P_brVSDisp_br    | real | 3.00 | 0.00 | in ; lbf          | Bearing Displacement ;                |
| Bearing Load                                      |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | LoadVStroke      | real | 3.00 | 0.00 | in ; lbf          | Displacement ; Load                   |
| ATTRIBUTE ADD                                     | StressVStrain_1  | real | 3.00 | 0.00 | microstrain ; ksi | Strain 1 ;                            |
| Stress 1  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | StressVStrain_2  | real | 3.00 | 0.00 | microstrain ; ksi | Strain 2 ;                            |
| Stress 2  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | StressVStrain_3  | real | 3.00 | 0.00 | microstrain ; ksi | Strain 3 ;                            |
| Stress 3  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | StressVStrain_4  | real | 3.00 | 0.00 | microstrain ; ksi | Strain 4 ;                            |
| Stress 4  |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | FxVSe_y          | real | 3.00 | 0.00 | microstrain ; ksi | Transverse Strain ;                   |
| Longitudinal Stress                               |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | EnergyVSTime     | real | 3.00 | 0.00 | ms ; in-lb        | Time ; Absorbed Energy                |
| ATTRIBUTE ADD                                     | ImpForceVSDisl   | real | 3.00 | 0.00 | in ; lb           | Impactor Displacement ;               |
| Impact Force                                      |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | ImpForceVSTime   | real | 3.00 | 0.00 | ms ; lb           | Time ; Impact Force                   |
| \$  |                  |      |      |      |                   |                                       |
| \$ Hygrothermal Relation Property Table           |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | Cp               | real | 1.00 | 1.00 | J/(g K)           | Specific Heat                         |
| ATTRIBUTE ADD                                     | Mm               | real | 1.00 | 1.00 | Wt %              | Equilibrium Moisture Content          |
| \$  |                  |      |      |      |                   |                                       |
| \$ Hygrothermal Lamina                            |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | TD1              | real | 1.00 | 1.00 | m^2/s             | Lamina Thermal Diffusivity (1-Dir)    |
| ATTRIBUTE ADD                                     | TD2              | real | 1.00 | 1.00 | m^2/s             | Lamina Thermal Diffusivity (2-Dir)    |
| ATTRIBUTE ADD                                     | TD3              | real | 1.00 | 1.00 | m^2/s             | Lamina Thermal Diffusivity (3-Dir)    |
| ATTRIBUTE ADD                                     | D1               | real | 1.00 | 1.00 | mm^2/s            | Lamina Moisture Diffusivity (1-Dir)   |
| ATTRIBUTE ADD                                     | D2               | real | 1.00 | 1.00 | mm^2/s            | Lamina Moisture Diffusivity (2-Dir)   |
| ATTRIBUTE ADD                                     | D3               | real | 1.00 | 1.00 | mm^2/s            | Lamina Moisture Diffusivity (3-Dir)   |
| ATTRIBUTE ADD                                     | CME1             | real | 1.00 | 1.00 | microstrain/Wt %  | Lamina Coefficient of                 |
| Moisture Expansion (1-Dir)                        |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CME2             | real | 1.00 | 1.00 | microstrain/Wt %  | Lamina Coefficient of                 |
| Moisture Expansion (2-Dir)                        |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CME3             | real | 1.00 | 1.00 | microstrain/Wt %  | Lamina Coefficient of                 |
| Moisture Expansion (3-Dir)                        |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CTE1             | real | 1.00 | 1.00 | microstrain/K     | Lamina Coefficient of Thermal         |
| Expansion (1-Dir)                                 |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CTE2             | real | 1.00 | 1.00 | microstrain/K     | Lamina Coefficient of Thermal         |
| Expansion (2-Dir)                                 |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CTE3             | real | 1.00 | 1.00 | microstrain/K     | Lamina Coefficient of Thermal         |
| Expansion (3-Dir)                                 |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CTC1             | real | 1.00 | 1.00 | W/(m K)/K         | Lamina Coefficient of Thermal         |
| Conductivity (1-Dir)                              |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CTC2             | real | 1.00 | 1.00 | W/(m K)/K         | Lamina Coefficient of Thermal         |
| Conductivity (2-Dir)                              |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CTC3             | real | 1.00 | 1.00 | W/(m K)/K         | Lamina Coefficient of Thermal         |
| Conductivity (3-Dir)                              |                  |      |      |      |                   |                                       |
| \$  |                  |      |      |      |                   |                                       |
| \$ Hygrothermal Laminate                          |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | TDx              | real | 1.00 | 1.00 | m^2/s             | Laminate Thermal Diffusivity (x-Dir)  |
| ATTRIBUTE ADD                                     | TDy              | real | 1.00 | 1.00 | m^2/s             | Laminate Thermal Diffusivity (y-Dir)  |
| ATTRIBUTE ADD                                     | TDz              | real | 1.00 | 1.00 | m^2/s             | Laminate Thermal Diffusivity (z-Dir)  |
| ATTRIBUTE ADD                                     | Dx               | real | 1.00 | 1.00 | mm^2/s            | Laminate Moisture Diffusivity (x-Dir) |
| ATTRIBUTE ADD                                     | Dy               | real | 1.00 | 1.00 | mm^2/s            | Laminate Moisture Diffusivity (y-Dir) |
| ATTRIBUTE ADD                                     | Dz               | real | 1.00 | 1.00 | mm^2/s            | Laminate Moisture Diffusivity (z-Dir) |
| ATTRIBUTE ADD                                     | CMEx             | real | 1.00 | 1.00 | microstrain/Wt %  | Laminate Coefficient of               |
| Moisture Expansion (x-Dir)                        |                  |      |      |      |                   |                                       |
| ATTRIBUTE ADD                                     | CMEy             | real | 1.00 | 1.00 | microstrain/Wt %  | Laminate Coefficient of               |

**TABLE 1. CONCLUDED**

|   |      |      |      |                         |                                 |  |
|---|------|------|------|-------------------------|---------------------------------|--|
| Moisture Expansion (y-Dir)                        |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CMEz                                | real | 1.00 | 1.00 | microstrain/Wt %        | Laminate Coefficient of         |  |
| Moisture Expansion (z-Dir)                        |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>x</sub>                    | real | 1.00 | 1.00 | microstrain/K           | Laminate Coefficient of         |  |
| Thermal Expansion (x-Dir)                         |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>y</sub>                    | real | 1.00 | 1.00 | microstrain/K           | Laminate Coefficient of         |  |
| Thermal Expansion (y-Dir)                         |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>z</sub>                    | real | 1.00 | 1.00 | microstrain/K           | Laminate Coefficient of         |  |
| Thermal Expansion (z-Dir)                         |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>x</sub>                    | real | 1.00 | 1.00 | W/(m K)/K               | Laminate Coefficient of Thermal |  |
| Conductivity (x-Dir)                              |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>y</sub>                    | real | 1.00 | 1.00 | W/(m K)/K               | Laminate Coefficient of Thermal |  |
| Conductivity (y-Dir)                              |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>z</sub>                    | real | 1.00 | 1.00 | W/(m K)/K               | Laminate Coefficient of Thermal |  |
| Conductivity (z-Dir)                              |      |      |      |                         |                                 |  |
| \$  |      |      |      |                         |                                 |  |
| \$ Graphical Data (General Hygrothermal)          |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CpVSTemp                            | real | 3.00 | 0.00 | deg C ; J/(g K)         | Temperature ; Specific          |  |
| Heat  |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD MiVSqrtTime                         | real | 3.00 | 0.00 | s <sup>1/2</sup> ; Wt % | sqrt(time) ; Moisture           |  |
| Content   |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD MmVSRH                              | real | 3.00 | 0.00 | %RH ; Wt %              | Relative Humidity ; Equilibrium |  |
| Moisture Content                                  |      |      |      |                         |                                 |  |
| \$  |      |      |      |                         |                                 |  |
| \$ Graphical Data (Lamina Hygrothermal)           |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>1</sub> vsTemp             | real | 3.00 | 0.00 | C ; microstrain/K       | Temperature ; Lamina            |  |
| Coefficient of Thermal Expansion (1-Dir)          |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>2</sub> vsTemp             | real | 3.00 | 0.00 | C ; microstrain/K       | Temperature ; Lamina            |  |
| Coefficient of Thermal Expansion (2-Dir)          |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>3</sub> vsTemp             | real | 3.00 | 0.00 | C ; microstrain/K       | Temperature ; Lamina            |  |
| Coefficient of Thermal Expansion (3-Dir)          |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>1</sub> vsTemp             | real | 3.00 | 0.00 | C ; W/(m K)/K           | Temperature ; Lamina            |  |
| Coefficient of Thermal Conductivity (1-Dir)       |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>2</sub> vsTemp             | real | 3.00 | 0.00 | C ; W/(m K)/K           | Temperature ; Lamina            |  |
| Coefficient of Thermal Conductivity (2-Dir)       |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>3</sub> vsTemp             | real | 3.00 | 0.00 | C ; W/(m K)/K           | Temperature ; Lamina            |  |
| Coefficient of Thermal Conductivity (3-Dir)       |      |      |      |                         |                                 |  |
| \$  |      |      |      |                         |                                 |  |
| \$ Graphical Data (Laminate Hygrothermal)         |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>x</sub> vsTemp             | real | 3.00 | 0.00 | C ; microstrain/K       | Temperature ;                   |  |
| Laminate Coefficient of Thermal Expansion (x-Dir) |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>y</sub> vsTemp             | real | 3.00 | 0.00 | C ; microstrain/K       | Temperature ;                   |  |
| Laminate Coefficient of Thermal Expansion (y-Dir) |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTE <sub>z</sub> vsTemp             | real | 3.00 | 0.00 | C ; microstrain/K       | Temperature ;                   |  |
| Laminate Coefficient of Thermal Expansion (z-Dir) |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>x</sub> vsTemp             | real | 3.00 | 0.00 | C ; W/(m K)/K           | Temperature ; Laminate          |  |
| Coefficient of Thermal Conductivity (x-Dir)       |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>y</sub> vsTemp             | real | 3.00 | 0.00 | C ; W/(m K)/K           | Temperature ; Laminate          |  |
| Coefficient of Thermal Conductivity (y-Dir)       |      |      |      |                         |                                 |  |
| ATTRIBUTE ADD CTC <sub>z</sub> vsTemp             | real | 3.00 | 0.00 | C ; W/(m K)/K           | Temperature ; Laminate          |  |
| Coefficient of Thermal Conductivity (z-Dir)       |      |      |      |                         |                                 |  |
| \$=====   |      |      |      |                         |                                 |  |

**NOTE:** Relation definitions omitted for brevity.

**TABLE 2. SAMPLE STANDARD INPUT FORMAT**

|                        |  |  |  |  |
|------------------------|--|--|--|--|
| TEST FACILITY:         | INTEGRATED TECHNOLOGIES INC. (BOTHELL, WA) |  |  |  |
| MATERIAL CLASS:        | COMPOSITE MATERIAL                         |  |  |  |
| MATERIAL SUBCLASS:     | AS4/RSL-1895                               |  |  |  |
| MATL FORM:             | FABRIC                                     |  |  |  |
| FIBER NAME:            | AS4  |  |  |  |
| MATRIX NAME:           | RSL-1895                                   |  |  |  |
| MATRIX SUBCLASS:       | EPOXY                                      |  |  |  |
| MATRIX MFR:            | SHELL                                      |  |  |  |
| REIN. CLASS:           | CONTINUOUS FIBER                           |  |  |  |
| FIBER MFR:             | HERCULES                                   |  |  |  |
| FABRIC MFR:            |  |  |  |  |
| FABRIC STYLE:          |  |  |  |  |
| FABRIC FILL NAME:      |  |  |  |  |
| FABRIC PICK COUNT:     |  |  |  |  |
| PREFORM ARCH:          | 2-D TRIAXIAL BRAID                         |  |  |  |
| PREFORM MFR:           |  |  |  |  |
| PREFORM ID:            | SLL  |  |  |  |
| SIZE AXIAL (K):        | 30   |  |  |  |
| SIZE BRAID (K):        | 6  |  |  |  |
| PERCENT AXIAL YARN:    | 46   |  |  |  |
| BRAID ANGLE (DEG):     | 70   |  |  |  |
| UNIT CELL WIDTH (IN):  | 0.458                                      |  |  |  |
| UNIT CELL LENGTH (IN): | 0.083                                      |  |  |  |
| STITCH THREAD MATL.:   |  |  |  |  |
| STITCH SPACING (IN):   |  |  |  |  |
| STITCH TOW SIZE (K):   |  |  |  |  |
| INTERLOCK CLASS:       |  |  |  |  |
| PERCENT WARP:          |  |  |  |  |
| PERCENT WEFT:          |  |  |  |  |
| PERCENT WEAVER:        |  |  |  |  |
| SIZE WARP (K):         |  |  |  |  |
| SIZE WEFT (K):         |  |  |  |  |
| SIZE WEAVER (K):       |  |  |  |  |
| PROCESS METHOD:        | RESIN TRANSFER MOLDING                     |  |  |  |
| PANEL MFR:             | BOEING DEFENSE & SPACE GROUP, SEATTLE, WA. |  |  |  |
| TEST TYPE:             | DOUBLE SHEAR BEARING                       |  |  |  |
| TEST REPORT ID:        | NASA CONTRACTOR REPORT 4609                |  |  |  |
| TEST CONDITION:        | ROOM TEMPERATURE                           |  |  |  |
| PERCENT 0:             |  |  |  |  |
| PERCENT 45:            |  |  |  |  |
| PERCENT 90:            |  |  |  |  |
| LAYUP CODE:            |  |  |  |  |
| SPECIMEN WIDTH (IN):   |  |  |  |  |
| NOMINAL THICK (IN):    |  |  |  |  |
| MEASURED THICK (IN):   |  |  |  |  |
| FASTENER CALLOUT:      |  |  |  |  |
| FASTENER MATERIAL:     |  |  |  |  |
| FAILURE LOAD (LBS):    | 4207.95                                    |  |  |  |
| FAILURE MODE:          | BEARING                                    |  |  |  |
| FAILURE LOCATION:      | AT HOLE                                    |  |  |  |
| NOTE 1:                |  |  |  |  |
| NOTE 2:                | CRITICAL BEARING LOAD: 3369.95             |  |  |  |
| NOTE 3:                |  |  |  |  |

  

| SCAN | LOAD(LB) | DISP(IN)                        | COD GAGE(IN) | TIME(SEC) |
|------|----------|---------------------------------|--------------|-----------|
| 1    | 0.12     | 0.0012                          | 0.0001       | 0.36      |
| 2    | 1.21     | 0.0350                          | 0.0095       | 0.98      |
| 3    | 3.36     | ....DATA OMITTED FOR BREVITY... |              |           |
| 494  | 4206.87  | 1.5095                          | 0.9834       | 129.87    |
| 495  | 4207.95  | 1.5098                          | 0.9837       | 129.99    |

| Tension Test Program |             |            |                       |                 |
|----------------------|-------------|------------|-----------------------|-----------------|
| specimen id          | plate id    | preform id | configuration         | gage length(in) |
| BH2-01-3A-1          | T7-SLL-B-3B | 2-D SLL    | baseline tension 1/8" | 7.00            |
| BH2-01-3A-2          | T7-SLL-B-3B | 2-D SLL    | baseline tension 1/8" | 7.00            |
| BH2-01-3A-3          | T7-SLL-B-3B | 2-D SLL    | baseline tension 1/8" | 7.00            |
| .                    | .           | .          | .                     | .               |
| .                    | .           | .          | .                     | .               |
| .                    | .           | .          | .                     | .               |
|                      |             |            |                       |                 |
|                      |             |            |                       |                 |

Figure 1 Example of Keypunched Data



| Spreadsheet                                |                             |  |           |            |            |            |            |
|--|-----------------------------|--|-----------|------------|------------|------------|------------|
| File Edit Function Database Format Display |                             |  |           |            |            |            |            |
|  | A                           | B  | C         | D          | E          | F          | G          |
| 1  | NOTE 1 >                    | FIBER VOLUME FRACTION:                       |           |            | CPN ID     | BH4-252    |            |
| 2  | NOTE 2 >                    |  |           |            |            |            |            |
| 3  | NOTE 3 >                    |  |           |            |            |            |            |
| 4  |                             |  |           |            |            |            |            |
| 5  |                             |  |           |            |            |            |            |
| 6  |                             |  |           |            |            |            |            |
| 7  |                             |  |           |            |            |            |            |
| 8  | MATL_CLASS                  | MATL_SUBC>                                   | MATL_FORM | FIBER_NAME | MATRIX_NA> | MATRIX_SU> | REINF_CLA> |
| 9  | COMPOSITE>                  | AS4/RSL-1                                    | FABRIC    | AS4        | RSL-1895   | EPOXY      | CONTINUOUS |
| 10   | =put("TES", H8:BS8, H9:BS9) |  |           |            |            |            |            |
| 11   | TEST FACI>                  | INTEGRATED TECHNOLOGIES, INC. (BOTHELL, WA,) |           |            |            |            |            |
| 12   | MATERIAL >                  | RTM COMPOSITE MATERIAL                       |           |            |            |            |            |
| 13   | MATERIAL >                  | AS4/SHELL 1895                               |           |            |            |            |            |
| 14   | MATL FORM:                  | FABRIC                                       |           |            |            |            |            |
| 15   | FIBER NAME                  | AS4  |           |            |            |            |            |
| 16   | MATRIX NA>                  | RSL-1895                                     |           |            |            |            |            |
| 17   | MATRIX SU>                  | EPOXY  |           |            |            |            |            |

Figure 2 MVISION Data Loading Spreadsheet for Keypunched Data

| Spreadsheet                                |                          |          |            |            |           |       |            |
|--|--------------------------|----------|------------|------------|-----------|-------|------------|
| File Edit Function Database Format Display |                          |          |            |            |           |       |            |
| S2   |                          |          |            |            |           |       |            |
|  | R                        | S        | T          | U          | V         | W     | X          |
| 1  | =put("tes",A2:Z2;A3:Z56) |          |            |            |           |       |            |
| 2  |                          |          |            |            |           |       |            |
| 3  | ID_of_Cou>               | Panel_ID | Panel_Lay> | Test_Prop> | Thickness | Width | Coupon_No> |
| 4  | 1F3T1#0                  | 1        | [+45/-45/] | TRANSVERSE | 0.222     | 6.04  | 0.75       |
| 5  | 1F3T2#0                  | 1        | [+45/-45/] | TRANSVERSE | 0.221     | 6.04  | 0.75       |
| 6  | 1F3T3#0                  | 1        | [+45/-45/] | TRANSVERSE | 0.223     | 6.04  | 0.75       |
| 7  | 1G4L-1#0                 | 1        | [+45/-45/] | LONGITUDI> | 0.224     | 2.02  | 0.5        |
| 8  | 1G4L-2#0                 | 1        | [+45/-45/] | LONGITUDI> | 0.219     | 1.96  | 0.5        |
| 9  | 1G4L-3#0                 | 1        | [+45/-45/] | LONGITUDI> | 0.222     | 2.01  | 0.5        |
| 10   | 1HL-1#0                  | 1        | [+45/-45/] | LONGITUDI> | 0.227     | 1.504 |            |
| 11   | 1HL-2#0                  | 1        | [+45/-45/] | LONGITUDI> | 0.226     | 1.502 |            |
| 12   | 1HL-3#0                  | 1        | [+45/-45/] | LONGITUDI> | 0.225     | 1.502 |            |
| 13   | 1HL-4#0                  | 1        | [+45/-45/] | LONGITUDI> | 0.228     | 1.502 |            |
| 14   | 1HL-5#0                  | 1        | [+45/-45/] | LONGITUDI> | 0.227     | 1.501 |            |
| 15   | 1I3L-1#0                 | 1        | [+45/-45/] | LONGITUDI> | 0.224     | 2.967 |            |
| 16   | 1I3L-2#0                 | 1        | [+45/-45/] | LONGITUDI> | 0.225     | 2.981 |            |
| 17   | 1I3L-3#0                 | 1        | [+45/-45/] | LONGITUDI> | 0.224     | 2.969 |            |

Figure 3 MVISION Data Loading Spreadsheet for Electronic Data

Query

Build the Query Command

Matl\_Subclass LIKE 'as4/rs1-1895' AND Preform\_Arch LIKE '\*stitched\*'

Clear

Previous Query Command(s) - Select to Recall

Matl\_Subclass LIKE 'as4/rs1-1895' AND Preform\_Arch LIKE '\*stitched\*'

Attribute List

Panel\_Tg\_Dry\_TM  
Panel\_Thickness  
Panel\_Vf  
Panel\_Vf\_TM  
Pbro  
Pbru  
Pbypo  
Pbypu  
**Preform\_Arch**  
Preform\_ID  
Preform\_Mfr  
Preload  
Prepreg\_FAW  
Prepreg\_Mfr  
Prepreg\_Notes  
Prepreg\_Orient

Attribute Information

Attribute name : Preform\_Arch  
Relation name : Preform  
Description : Preform Architecture  
Units :  
Type : STRING

Query Operators

= != < > <= >=

+ - \* / ( )

AND OR NOT

Like Exists

Help

Apply

Cancel

Figure 4 MVISION Query Panel

Spreadsheet Select

Select from Database

⬆ Test

✓ Design

✓ Analysis

✓ Build "Attributes to Select"

Notes Test\_Prop\_Class Panel\_Layup\_Code Process\_Method Test\_Temperature Impact\_Energy Fcail

Clear

⬆ Build "Conditions for Query"

Test\_Type LIKE 'compression after impact' AND Matl\_Subclass LIKE 'as4/im7/3501-g'

Clear

Attribute List

Matl\_Chem\_Family  
Matl\_Class  
Matl\_Designation  
Matl\_Form  
Matl\_HSDS  
Matl\_Max\_Temp  
Matl\_Min\_Temp  
Matl\_Name  
Matl\_Spec  
**Matl\_Subclass**  
Matl\_Tg\_Dry

Attribute Information

Attribute name : Matl\_Subclass  
Relation name : Material  
Description : Generic fiber/matrix fami  
Units :  
Type : STRING

Query Operators

= != < > <= >=

+ - \* / ( )

AND OR NOT

Like Exists

Apply

Cancel

Figure 5 MVISION Select Panel



# Spreadsheet

File Edit Function Database Format Display

|    | A   | B          | C          | D          | E          | F          | G    |
|----|---|------------|------------|------------|------------|------------|------|
| 1  | Test_Type LIKE 'compression after impact' AND Matl_Subclass LIKE 'as4/im7/3501-6' |            |            |            |            |            |      |
| 2  | Preform_A)  | Test_Prop> | Panel_Lay> | Process_M) | Test_Temp> | Impact_En> | Fcai |
| 3  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 120        | 52.7 |
| 4  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 240        | 47.3 |
| 5  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 240        | 49.9 |
| 6  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 480        | 40.7 |
| 7  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 480        | 43.2 |
| 8  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 840        | 35.2 |
| 9  | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 840        | 39.7 |
| 10 | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 840        | 40.7 |
| 11 | STITCHED >  | LONGITUDI> | [+45/-45/> | RESIN FIL> | 70         | 840        | 41.1 |
| 12 | STITCHED >  | TRANSVERSE | [+45/-45/> | RESIN FIL> | 70         | 120        | 28.5 |
| 13 | STITCHED >  | TRANSVERSE | [+45/-45/> | RESIN FIL> | 70         | 240        | 25.6 |
| 14 | STITCHED >  | TRANSVERSE | [+45/-45/> | RESIN FIL> | 70         | 480        | 17.3 |
| 15 | STITCHED >  | TRANSVERSE | [+45/-45/> | RESIN FIL> | 70         | 480        | 19.5 |
| 16 | STITCHED >  | TRANSVERSE | [+45/-45/> | RESIN FIL> | 70         | 840        | 16.3 |
| 17 | STITCHED >  | TRANSVERSE | [+45/-45/> | RESIN FIL> | 70         | 840        | 18.4 |

Figure 6 MVISION Spreadsheet Select Output

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| 13. ABSTRACT (Maximum 200 words)<br><br>This report describes the approach followed to develop a database for mechanical properties of textile composites. The data in this database is assembled from NASA Advanced Composites Technology (ACT) programs and from data in the public domain. This database meets the data documentation requirements of MIL-HDBK-17, Section 8.1.2, which describes in detail the type and amount of information needed to completely document composite material properties.<br><br>The database focuses on mechanical properties of textile composite. Properties are available for a range of parameters such as direction, fiber architecture, materials, environmental condition, and failure mode. The composite materials in the database contain innovative textile architectures such as the braided, woven, and knitted materials evaluated under the NASA ACT programs. In summary, the database contains results for approximately 3500 coupon level tests, for ten different fiber/resin combinations, and seven different textile architectures. It also includes a limited amount of prepreg tape composites data from ACT programs where side-by-side comparisons were made. |   |  |   |   |
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